

DISCOVERY

Monthly Popular Journal of Knowledge

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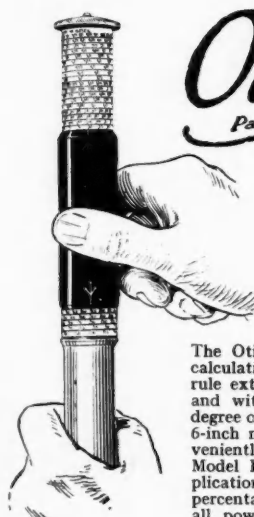
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Notes of the Month.

THE unprecedented popularity of books by Sir James Jeans and other modern writers was discussed in our review columns last month. The number of people with a scientific training is growing all the time, but that is not sufficient to explain a sale of eighteen thousand copies for "The Universe Around Us," within a week of publication. Dr. Pullin suggested that the explanation lies in the philosophical curiosity which is fundamental in human consciousness. No doubt this factor accounts for a great deal of the popular interest in science; we believe that there is another reason, so far unnoticed by the critics, which provides the best possible support for the truth of modern scientific evidence. Until recent years a certain aggressiveness on the part of science did much to antagonize those who felt that human experience could not be explained in terms of the test-tube. In self-defence, many thoughtful people were driven to the other extreme and adopted a frankly mystic attitude towards the riddle of life. Although the scientists of the last century were not so materialistic as is sometimes supposed, their dogmatic assertions were often calculated to offend, especially when later work showed them to be in error. What distinguishes modern writers is a readiness to admit the limitations of science and a recognition that its methods cannot be rigidly applied to spiritual or religious experience. In consequence, the ordinary man feels that scientists are at last advancing a view which accords with his own convictions, and that he can take an interest in science without the fear

that it will merely prove him to be hugging an illusion. Science no longer appears as a superior intellect which can explain everything in material terms.

* * * * *

This new interest in science and philosophy is one of the most hopeful signs of modern progress. We cannot therefore agree with Sir William Pope, who in a recent lecture suggests that no progress has been made for centuries in literature, in many of the arts and probably in moral philosophy. He further asserts that no novel conception has been introduced, and that the only change consists in the re-presentation of age-old material in a form which meets the taste of the current period. Sir William supports the view that prehistoric man was a creature practically indistinguishable, physically and mentally, from his present descendants. As evidence that "modern man is in no way the intellectual superior of his predecessor," it is pointed out that languages invented thousands of years ago were probably more expressive and flexible than any modern tongue. Literatures sprang into being depicting every human emotion and aspiration with a delicacy and perfection still unsurpassed, while the goldsmith and sculptor were producing gems of art five thousand years ago which defy modern competition. Evidently Sir William Pope does not sympathize with human evolution, though he modified this somewhat cynical view by adding that "the intensive work carried out in science during the last fifty years has launched us well beyond the shore of a new era in the world's history, an era which may be described as the scientific age."

* * * * *

The acquisition of the Bedford Book of Hours for the nation is noteworthy for several reasons: the generosity of an American, Mr. Pierpont Morgan, who lent the British Museum £33,000 for the purchase of the manuscript; the achievement of the trustees themselves in clearing the debt within a year; the liberal co-operation of the National Art Collections Fund; and the enthusiastic support of individual subscribers. The Book is the one surviving example of the work prepared by mediaeval English artists

for the first Duke of Bedford, a liberal patron for whom many of the most beautiful fifteenth-century manuscripts were made. Although much of his life was spent in France, his personal tastes remained essentially English. The Book of Hours was used in his private chapel and a similar volume prepared for him in Paris was decorated with English saints and heroes. In *Discovery* this month an historian outlines Bedford's career as English Regent of France, the importance of which in mediaeval politics is not generally recognized.

* * * * *

Another article in this issue describes new discoveries relating to the Pueblo ruins. An ingenious attempt is being made to arrive at the date of these ruins by means of the growth of trees. Dr. A. E. Douglass, in studying past climatic conditions in south-western America as expressed in the growth rings of trees, has developed a method whereby he can tell whether trees from which logs have been cut were growing at the same time, or to what extent their life period overlapped. The identity or differentiation in the position of the rings indicating exceptional climatic conditions, or any change in these conditions, serves as a time gauge. By this means, working back from logs of which the date of cutting was known, Dr. Douglass has been able to construct a time chart which goes back to the year A.D. 1300. By a comparison with this chart he can fix the date of cutting any given tree. This method has been applied to the pine and spruce logs from Pueblo structures now in ruins. For some time a gap existed between the year 1300 and the latest remains of the Pueblo III period. Dr. Douglass has succeeded in bridging this gap, and the absolute dates of the relative date series is now being worked out.

* * * * *

Every branch of scientific research is expanding so rapidly that restrictions of space present a pressing problem. The Department of Entomology at the Natural History Museum, for instance, has found the utmost difficulty in housing its growing collection of insects. The difficulty has now been overcome with the help of the Empire Marketing Board, which is financing a new building for entomological research. There are six million insects in the collection, and the numerous students anxious to study them will now have adequate facilities. A development of similar interest is the Zoological Society's acquisition of four hundred acres at Whipsnade, Bedfordshire. Work is already in progress in preparing a zoological park, where animals will be exhibited as far as possible in their natural surroundings. It is proposed that

only a limited number of animals will be retained at Regents Park. A system of exchange will enable all the animals to have the advantage of country air and surroundings periodically. Many visitors to the Zoo must have sympathized with the animals in what seems to be very restricted captivity, and will welcome a project which provides so much more liberty.

* * * * *

Following our recent report on telephoning from trains in Canada, a new facility is announced for railway passengers, this time due to British enterprise. The first train to be fitted with a wireless receiving set now runs each day between London and Leeds. A three-valve set is coupled with the lighting system, and headphones are connected by plugs from a wire which leads to the guard's van. The project is still in the experimental stage and several difficulties have to be overcome. Reception is almost perfect when the train is moving slowly, but considerable interference is encountered at high speeds, and reception becomes faint as the train passes through tunnels and stations. When these difficulties have been overcome the system will be adopted on a more extensive scale.

* * * * *

The Editor of *Discovery* will shortly sail for South America, where he will represent the publishers' interests at the Buenos Aires Exhibition. The outward journey will be made by way of the Panama Canal to Valparaiso. After making a short stay in Chile, Mr. Benn intends to cross the Andes into Argentina, to attend the opening of the Exhibition by the Prince of Wales. One of the attractions at Buenos Aires will be an international motor-boat regatta at which a new attempt on the world's speed record is to be made. The English entrants include Lord Wakefield's "Miss England II." Before leaving the Argentine, the Editor hopes to visit the Bovril estates near Rosario, and he will probably cross the frontier into Uruguay. These journeys should provide some interesting notes on South American conditions, which will be published in *Discovery* later in the year.

* * * * *

The reported discovery in a South American jungle of a very rare orchid has led two enterprising Canadians to set sail from Montreal in search of the plant. A British engineer claims to have seen a specimen of the "Tiger Head" while cutting a path through the forest, and this is the only information which the investigators have as a basis for their search. They are members of the Smithsonian Institute of New York, and already have to their credit the discovery of the first "Nun's Head" orchid, which was purchased by a wealthy collector for £33,000.

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The "Vanished People" of America.

By Bruce Bryan.

The discovery of fragments of pottery in the south-western states has thrown interesting new light on prehistoric American culture. The remains have been classified and it is possible to trace a consecutive history of the pueblo Indians who inhabited this part of the United States long before the advent of the white man.

THE finding of sherds has provided the key to the ancient cultures of the South-west in the United States. The Rosetta stone gave us the secret of Egypt's hieroglyphics, but no such writings have ever helped to reveal the history of the people who inhabited America ages before the advent of the white man. All that remains to-day of these cultures is the ruin of stone-walled dwelling-places, or *pueblos*, fragments of stone and bone implements, and the smashed pottery sherds which abound in these prehistoric sites. Almost every shovel-load of earth dug from an ancient pueblo in any of the states of Colorado, Utah, Arizona, or New Mexico, contains at least a handful of sherds. These have come to be, perhaps, the most common of all primitive relics in South-west American archaeology, and for years they were disregarded and tossed aside as being of no value. Occasionally, a whole vessel, or olla, would be unearthed, and that was considered sufficient to give an idea of the type of utensils made by the people who once inhabited this type of dwelling-place.

These fragments of pottery are now recognized as a valuable key to the unknown story of pre-Columbian America. For several years scientists have been collecting, sorting and classifying the fragments; the vessels were all smashed according to the habit of almost all primitive people, who believed that by so doing they were killing the spirits of these bowls. The earliest inhabitants of the Lower Gila region in southern Arizona are spoken of by the race which now inhabits the surrounding country as "The Vanished People," and it is known that they made a typical form of ceramic ware called "red-on-buff." Strangely enough, this ware is peculiar to

that region alone; it is found nowhere else within the vicinity of a few hundred miles, unless it has been traded in the various channels of commerce which existed even in the earliest times. As time went on, the development of the potter's craft spread to all parts of the South-west, but each culture developed along its own lines and produced a type of pottery peculiar to itself. The earliest form of pottery made in America was of a very crude texture and design, close upon the heels of which came the craftsmanship of the earliest pueblo Indians, so called because of the type of dwelling-place in which they lived. Their contributions to the craft included plain uncoloured ware with the neck coiled, coiled ware sometimes decorated with thumb-nail incisions, and a later development of corrugated pottery.

No wheel, mould or half-section was ever used to turn a piece of pottery; bowls and urns of remarkable beauty were fashioned slowly by hand. The clay was taken from its natural deposits, brought into the village fire cists, and thoroughly ground to powder in huge stone mortars, themselves hollowed and rounded from solid stone with laborious care, and then kneaded into a malleable mass of wet clay. After the substance had been treated with mica or sand tempering, it was considered ready for shaping,

and it was then rolled into long spirals. These were coiled, one spiral above another, and the vessel was worked into shape by hand and dried in the sun. It was then put into the hot cist and slowly baked. As the art advanced, the potters began to smooth out the coils with rough rubbing stones until the original rolls or layers were concealed. At first, the smoothed bowls bore no decoration, but later



THE HOME OF THE VANISHED PEOPLE.

Archaeologists searching for fragments of pottery among ruins in the Mimbres Valley region of New Mexico where the black-on-white ware was produced.

they were incised with indented patterns, sometimes of a very simple type, and at others with an ingenious geometric design. Such elaborations were made with the thumbnail, or with special stone or bone implements. Uses for this ware varied. Some of the bowls were designed merely to hold water or grain; the water bowls were narrow-necked, while the grain and acorn containers were wide-mouthed. Other smaller vessels were used for cooking; smoke from the cooking fires blackened them, and apparently the Indians became interested in this appearance, for later they commenced to blacken their pots deliberately by overfiring them in certain spots. Probably the practice of making coloured ware, with designs painted on the inside or outside of the vessel, did not come until much later, though in most pueblos excavated, plain red ware, coiled ware, and the usual black-on-white ware are to be found in contemporaneous positions.

In the Lower Gila culture, the red-on-buff type is a contemporary of the black-on-white of other areas. In fact, the red-on-buff of the Casa Grande people is so unlike other pottery, and the dwelling-places are so dissimilar in form and architecture from any other, that archaeologists were long reluctant to assign them to the pueblo Indian period. It was thought that they might more nearly represent a branch of some unknown civilization, perhaps of a Mexican race, either Aztec or Toltec. The pueblo Indians who inhabited the Mimbres Valley in southern New Mexico developed a type of black-on-white ware which shows considerably more intricacy in design than any other example of early craftsmanship. The Mimbrenos achieved a straight line by running the yucca paint brush along a tightly stretched fibre. Their pottery was decorated with some form of animal or human life, and is typical of that region alone. It is thought that the Mimbres art owed its origin to the genius of one artist, whose work established a new school of craftsmen. At the Swarts ruins and at the Galaz ruins in New Mexico, examples of pottery were found which point to a definite totemism among the "Vanished People." In one room of the Swarts ruin, for instance, all the vessels excavated bore the image of a lizard, which

was doubtless the totem of the family which inhabited the room.

The art of making pottery without the use of a wheel upon which to shape it has been lost since the advent of the white man. To-day there are comparatively few Indians left, and they still inhabit houses which are almost identical with the pueblos in which their forefathers lived. But there is one notable difference: whereas the prehistoric native dwelt in a house which had no windows or doors as we know them—entrance was obtained through a trap in the roof—the modern dwelling has both glass-paned windows and hinged door. Direct descendants of

the early craftsmen still occupy ancestral homes, or, at least, houses which are identical with those of their forebears, at Zuni, Taos, Acoma and San Ildefonso; several of the houses date back to the time before the white man came. To-day, however, the Indian has lost the art of perfection in pottery making. Just as he has found it much more congenial to enter and

leave his home through a swing door, he now finds it easier to carry water in a modern tin rather than in the beautifully decorated ollas.

The pottery of the primitive Indians of South-west America is in many ways similar to that of other early cultures; in as many other ways it is dissimilar. Despite the absence of a wheel on which to turn the bowls for shaping, and of a mould in which to form them, those we have recovered have many varied and pleasing shapes and glazes. Some are basket-shaped, some perfectly rounded, some globular, some squat and some vase-like. Many have straight rims, others are wide and flaring; numerous bowls have delicately formed rims which curl over and turn down against the body of the bowl. Handles are worked in every conceivable fashion. In some of the cultures, the handles represent a part of the anatomy of human beings or animals, such as a head, foot or limb; in others, the entire body of an animal is represented, such as in the coiled piece from the Mimbres Valley, the handle of which is moulded into the form of a dog. Incidentally, this would seem to suggest, among other things, that the early Indians had domestic animals. The method of making pottery was



PUEBLO INDIAN DRINKING VESSELS.

In many of the vessels discovered the handle is moulded into the form of a human limb or an animal, such, for instance, as the dog in the drinking jug illustrated.

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apparently similar throughout all branches of the pueblo Indian race. First the clay was worked into a pliable material, then the bowl was built up by coiling layers of wet clay into the shape desired. In the more advanced ware, this was smoothed down until no trace of the original coiling was left. Mixed with the clay was a fine tempering of sand, shist, mica or other material, which helped to toughen the body of the vessel and to hold it together; this also prevented cracking during firing. The bowl was finally coloured and designed with the intricate decorations peculiar to the tribe to which the potter belonged.

At the Pecos ruins, it was discovered that various delicate glazes had been applied to the pottery. The glazes, varying in artistry and workmanship, have now been classified. It is sometimes difficult to decide whether certain samples of plain ware which are black inside are smoke-blackened purposely, smudged from contact with fire, or polished for decorative reasons. All three types are highly prevalent in the South-west, and especially in the Lower Gila area. Highly polished black surfacing was as much a type of decoration as painted designs. Usually, in the higher type of pottery, representing the apex of the art achieved, the painted decorations are baked into the entire vessel. In others, the paint has been added after the firing. Many of the Mimbres Valley sherds have seemed at first to be fragments of bowls depicting red-on-white designs, but it has subsequently been learned that most of these are merely examples of over-firing in which chemical reactions have changed the original and intended black chrome to a dull reddish tone. Similarly, the white slip often appears as yellow or buff, which is occasionally extremely misleading.

One type of pottery is famous for a particular tone, which has come to be universally recognized among archaeologists as Jeddito yellow, the name being taken from that of the village itself. This is as typical of that culture as the red-on-buff is of the Lower Gila. Indians in the Chihuahua area developed a naturalistic shape in which the pottery itself conforms to a human or animal body. Thus, the lip of a pitcher is in the form of the bridge of a man's nose, and on

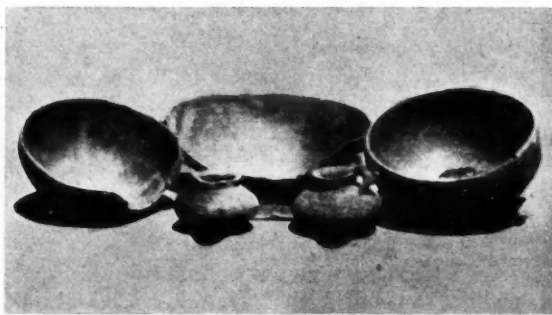
either side his eyes are painted. Handles are sometimes representations of birds' or animals' heads, while the mouth of an olla often forms the mouth of some form of life to which it has been modelled. Often a piece is found with a handle in the shape of a parrot head, while on the other side a corresponding handle is formed in the shape of the bird's feathered tail. Polychrome, or two- and three-coloured pottery, represents the acme of the potter's art in the South-west. The polychrome of the Casas Grandes region in Chihuahua, not to be confused with the red-on-buff and polychrome ware of Casa Grande in Arizona, is said to be unsurpassed by any other type of pueblo-

Indian ceramic development. This pottery has a unique motif which is easily recognizable, although it also contains many of the characteristics of other cultures.

Pottery from the ruins of Chaco Canyon in the San Juan area is chiefly distinguishable for its peculiar hatching effect. Groups of parallel black-on-white lines, bordered with heavier black lines in

triangular and right-angled positions, are the general type, although this region is also noted for its corrugated and plain ware. It is largely because of this widely diverse type of ceramic development that ethnologists are able to piece together a consecutive history of the original inhabitants. Widespread cultural movements, emigrations, invasions, the progress of early commerce, and the gradual development of art may be traced through the fragments of pottery found in the caves and cliffs of South-west America.

Pecos, in northern New Mexico, is now generally thought to be one of the original seven cities of Cibola, and relics of one of the sixteenth century Spanish churches still stand there. Recent archaeological discoveries in this region have completed the history of pottery in South-west America from the time of its earliest inception to its highest development at the advent of the white man. Efforts are being made to bring about a renaissance in the potter's craft, and inducements are being offered to modern pueblo-Indians to take up again the work of their ancestors. Specimens of ancient pottery, dug out of primitive burial grounds by the itinerant pot hunter or vandal,



EARLY MEXICAN CRAFTSMANSHIP.

In spite of the absence of a wheel on which to turn their vessels, the early potters of Mexico brought their craftsmanship to a remarkable degree of perfection.

have realized fabulous prices, but while superb examples are frequently discovered and sold to a museum or collector for a huge profit, this type of digger is to be discouraged. In his ruthless search, he does incalculable damage to walls, floors and other archaic remains which would otherwise prove of inestimable value to the genuine archaeologist.

Most of the pottery discovered in ancient cemeteries is, unfortunately, smashed to pieces. Some of the vessels have only a small hole knocked in the bottom from the inside, while others are damaged beyond all hope of repair. Many of the most beautiful ceramic works are, therefore, lost to succeeding generations of art lovers.

The foregoing article, by an American contributor, may be amplified briefly for English readers. The south-western States have for some years past been the subject of intensive study by anthropologists, and many expeditions have been sent out to excavate its ruined villages. The area of pueblo culture comprises Arizona, New Mexico, Nevada, Southern Colorado, and Utah, a part of Western Texas and Northern Chihuahua, and consists of desert plains, plateaux, canons, mesas, high forested mountains, and perennially watered and very fertile valleys. It is known to anthropologists as the "Arid Region." Although inhabited by a number of different tribes, linguistically related, it produced a generally uniform and strongly specialized culture in which there developed, over a long period, thousands of small houses built of masonry. Later, under hostile pressure, the population concentrated in large many-storeyed community *pueblos*, accommodating many hundreds of people. Situated on cliffs or the slopes of valleys, these cliff-dwellings were terraced one above another with well protected outer walls and having one entrance only. Both stone and a form of concrete were used as building material. The well-known Casa Grande, built of the latter material, has walls three to five feet thick, and still rising to a height of twenty to twenty-five feet, though originally they must have been double that height as the building had four storeys as against its present two.

A Race of Agriculturalists.

The people were agriculturists, their culture being based on the cultivation of maize, and their dwellings were situated in or near the valleys for convenience of tillage. They practised irrigations by means of canals, some of them being traceable for miles. They also had enormous water storage reservoirs. The pottery with which our article deals was the finest

in America north of Mexico, far surpassing that of the Mississippi Valley, although the people of that area were in other respects the most advanced in culture of the North American peoples excepting the inhabitants of Mexico and adjacent areas.

Recent intensive study of the culture of the "Arid Region," and especially of the pottery, in accordance with the rules of archaeological interpretation has revealed the chronological succession to which our contributor refers. About fifteen to twenty centuries before Christ maize cultivation was taken up by a previously nomadic or semi-nomadic long-headed people who made coiled basketry, used the throwing-stick (*atlatl*) but had no pottery and no substantial habitations. In view of the place of basketry in their culture, they are known as the Basket-Makers, and the period as Basketmaker I. In the period Basketmaker II life became more settled. Pottery was introduced in Basketmaker III, and the bow and arrow began to supplement the *atlatl*.

Introduction of Cotton.

At the end of this period a new broad-headed people appear, or, at any rate, skull deformation was initiated. In this Proto-Pueblo or Pueblo I Period, cotton was introduced, and the black-on-white and coiled-neck pottery becomes characteristic. The circular ceremonial chamber called *kiva*, which thenceforward plays a great part in pueblo life, was introduced. This was a period of transition, in which first appeared the rectangular building with upright walls, which made possible the juxtaposition of two or more buildings and opened the way for the development of the many-celled communal dwelling. In Pueblo II, culture developed rapidly; small-village life was extended over a wide area. In the next period, the great period, Pueblo III, life in the small, widely scattered villages, was abandoned; there was a concentration of the people in certain areas with great architectural and ceramic development as well as regional specialization. The following period, Pueblo IV, or Proto-historic, witnessed a great decline in culture. The population shrank, and large areas were left vacant. This period came to an end with the settlement of the south-west by the Spaniards in the seventeenth century. The historic period, Pueblo V, then began, and continues to the present day.

The following tentative dating has recently been suggested. Pueblo V 1700 to present day; Pueblo IVb 1540 to 1700; IVa 1350 to 1540; Pueblo III 900 to 1300; Pueblo II sixth century to 900; Pueblo I beginning approximately at the dawn of the Christian era.—EDITOR, *Discovery*.

Industry and Decorative Art in Kashmir.

By W. Bosshard.

Kashmir is famous for its silk and carpets, but other and lesser known crafts are carried on in the country on an extensive scale. While the modern Kashmiri inherits an almost unique artistic sense, he appears to lack the creative genius of his forefathers, and many native industries are fast deteriorating.

A COUNTRY which lies on one of the important caravan routes connecting China, Russia and Persia with the Indian plains, must needs undergo the influence of the people travelling through it. To the most ancient industries and, to-day, the most important, belong the rearing of the silkworm and the spinning of the precious thread. According to legend, a Chinese princess who married the King of Khotan, in Central Asia, wore the seeds of the mulberry tree and the eggs of the silkworm concealed in her head-gear, and afterwards taught the people of her adopted home to spin the silk thread.

Export of silkworms or mulberry seeds from China was at that time prohibited on pain of death, but Chinese Turkistan was far from Peking and the imperial court, and the princess felt sufficiently secure under the protection of her consort.

The art of silkworm rearing spread in all directions, and it is probable that it was spun in Kashmir as early as the seventh or eighth century. We have, however, no certain knowledge of it before the sixteenth century. A chronicle written in 1536 speaks of the large number of mulberry-trees throughout the valley, and we are told that they were planted solely for the purpose of feeding the silkworm. Until the year 1869

little is known; it had probably remained until then a home industry which, despite the fact that it dated back centuries, was still in a very primitive state of development. But in 1869, the reigning prince of Kashmir turned his attention to the rearing of silkworms and made it a state monopoly. True, the state at the time lacked technically trained men to superintend the work and, although a few new methods, especially in the spinning of the thread, were introduced, the catastrophe which befell the silk industry in 1878 could not have been averted. A disease

attacked the entire breed and destroyed it completely. For about four years the industry remained in a moribund condition, and from 1882 until 1889, the rearing of the silkworm was left to individual peasants.

In 1896, a new attempt was made, and experts were admitted who placed the whole enterprise on a scientific commercial footing. The eggs were microscopically examined and cross-breeding with others imported from Europe was effected. The results were so highly favourable that the importation of eggs, which in 1898 amounted to just twelve kilos, increased to 715 kilos in 1903. Simultaneously, the number of silk producers, which had sunk to about four hundred, increased by twenty-five



KASHMIRI WOODWORK.

This screen is a typical example of Kashmiri wood carving. The delicacy of their craftsmanship is remarkable in view of the primitive tools which are used.

times. Machines were for the first time imported from Europe, the old-fashioned spinning mills with their primitive reels were abolished, and new buildings sprang up outside the town. In 1904, there were more than four thousand workmen employed in them, and the undertaking had attained an unexpected degree of prosperity when, in 1913, a fire broke out and destroyed more than thirteen hundred reels and the total year's crop, consisting of about three thousands tons of cocoons. Although the reconstruction was taken in hand in 1914, it was fully four years before work could be resumed on the former scale—a delay for which the outbreak of war and the consequent difficulty

in obtaining the machines were mainly responsible.

Silk production in all its phases is now once more a State industry. Srinagar is the distributing centre, from which the various villages of the whole valley are annually supplied with thousands of mulberry-trees. There, even the ravines and what had hitherto been waste land are planted with these trees which, owing to the favourable climatic conditions, thrive exceedingly well. The trees remain state property, even when they stand in private ground, and they are distributed among the individual silkworm rearers by the elder of the village. As this industry is a State monopoly, every rearer automatically becomes a State official. From the central station at Srinagar, each of them has allotted to him a certain number of microscopically examined eggs which have been passed as healthy; the quantity varies according to the size of his house and family. These he takes to his house and places them in a primitive incubator, which he strives to keep at a temperature of 24° centigrade. At the end of four or five days, the worms creep forth and are fed on mulberry leaves. They live for about a month and then begin to spin their fine thread and hang their cocoons to the straw or mustard stalk that has been kept in readiness. The chrysalid state



PAPIER MÂCHÉ DEALERS.

Once an important industry, papier mâché is now on the wane, largely owing to the degeneracy of native artists and the lack of former ideals.

once over, the worms are left for about five days to themselves, then the peasant gathers the cocoons, exposes them for a day to the hot sun—whereby the maggot is destroyed—and carries his crop to Srinagar, where a sum fixed by the State is paid to him for the goods delivered. As the State bears all risks, the price is, of course, much lower than the market value of the cocoons.

The number of rearers registered at the central works at Srinagar amounts to-day to over 60,000; if we include their families who assist them in their daily task, we arrive at the by no means inconsiderable total of 200,000 people who earn their living practically by silkworm breeding. At the spinning

mill in Srinagar, the cocoons are dried a second time, then sorted and finally stored in store-houses. Above five hundred men and women are daily employed in sorting the cocoons according to their various qualities. This factory, the largest of its kind in the world, produced in 1925 over 80,000 kilos. of first quality silk and about 50,000 kilos. of schappe. The total number employed in all the mills is over 3,500 men, who understand the working of the newest machines as well as if they had been bred in a factory. Yet the humming of the wheels and reels is a new thing; the first large hall was only finished at the end of 1926, and a second one of the same size is approaching its completion. The quality produced by this factory is said to equal that of French and Italian silk manufactures and will be still improved as soon as the rearing of silkworms proper, which is in the hands of the poor and conservative peasantry, can be placed on a more modern basis; for this, unluckily, the State government provides no credit.

The major part of the silk is sent in skeins to Italy, France and America, which consumes 85 per cent of the universal production. Switzerland, for reasons unknown to me, has hitherto shown little interest in this market. The present director of this State

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enterprise, who looks back with pride to thirteen years of activity, has still to cope with many obstacles; the great progress made, and not least the financial success, are due to his indefatigable efforts and his great technical skill.

The carpet industry comes next in importance. This, too, was introduced centuries ago by the Persians, who excelled in the art, but it remained until the 'eighties a home industry, mostly occupying the house inmates during the cold winter months. Until the outbreak of the Franco-Prussian war, the beautifully coloured Kashmir shawls nearly all went to Paris. The heavy war indemnity imposed on France by Germany in 1871, however, brought about the ruin of the trade. Paris had no longer the money to pay for the expensive cloths, and the leading industrialists in Kashmir were lacking in the broader view and energy necessary for a new market. Enterprising Europeans conceived the idea of employing these idle hands, used to the most delicate work, for carpet weaving. The experiment was crowned with success, so that at the present time no less than five thousand workmen are occupied in this branch of industry all the year round.

It is both interesting and instructive to follow the making of a carpet through all its stages. In a

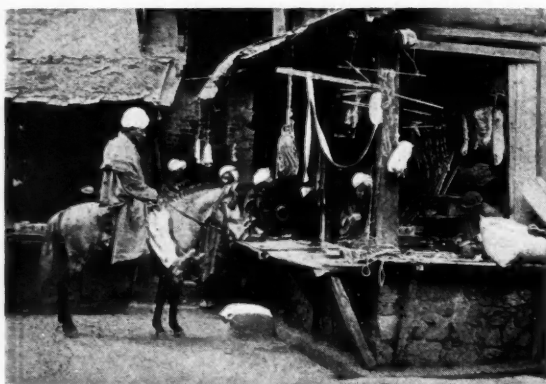
primitive room, whose air-holes are stopped up with paper, the designers sit drawing new or copying famous old patterns. Others sit beside them at low desks, taking down the various colours to be employed in Persian or Arabic characters on slips of paper which sometimes cover a space of ten centimetres. These are then collected by a man whom I would call the "librarian," are bound with a string, and carefully kept in a drawer. As soon as a carpet is to be started, one strip after another is given to a weaver, who, without having the slightest notion of the final effect of his work, combines the various colours as they have been jotted down for him. Like the buzzing in a class-room of school children learning by heart, the visitor on entering the carpet manufactory will hear the voices of hundreds of men as they hum to themselves: "Three threads red, two threads green and ten threads white!" Many of the carpets, especially those copied from ancient museum pieces, demand the labour of months.

Shortly after my arrival in Kashmir, I saw three magnificent specimens, each of which had kept two to three workmen busy for over a year. Carpets of such quality, the prices for which already run into five figures, go with few exceptions to the United States, while cheaper types are purchased by England



ONE OF THE SEVEN BRIDGES WHICH SPAN THE RIVER JHELM.

That the native craftsmen do not find inspiration for their artistic genius in the beauty of their surroundings is suggested by this glimpse of Kashmir scenery.



A SHOP IN KASHMIR.

The author points out that the modern tourist, with his mania for cheap souvenirs, is to be held responsible for the degeneracy in many Kashmiri crafts.

and, less frequently, by continental countries. The greatest secret in the art of carpet-making is the dyeing of the wool and the combination of various colour-tones. The usual visitor, however, rarely has a chance of seeing silk or carpets. Much commoner than both are *papier mâché* work, embroidery, and carved wood-work. *Papier mâché*, which attained the height of its popularity in the days of the Mogul emperors, is now on the wane; not that there is any lack of material: on the contrary, but quantity has killed quality. Probably imported from once-flourishing Persia, it was formerly employed by a few artists, who, under the protection of wealthy princes, had no need to worry about earning their daily bread. The modern tourist and globe-trotter, with his mania for cheap souvenirs, is perhaps to be held responsible for the present corrupt state of this handicraft, although the main cause seems to me to lie in the degeneracy of the Kashmiri and a total lack of former ideals.

Artists of the middle ages did not work for wages or by the hour; they sat down with their *narghile* and brush whenever they felt inclined in one of the luxurious gardens, and in the shade of a platane painted birds, foliage and blossoms in motley confusion and delicate colours. When they were tired, they rolled up their carpet and sauntered home, unharassed by the troubles of daily existence. Nowadays it is different; half-a-dozen people, men and boys, sit together in narrow, dark rooms, painting boxes, vases, little tables and plates. Their products are poor, but they find a ready sale among travellers. One, or perhaps two men only are still capable of making designs of classical beauty and noble lustre. The subjects that one would wish to examine with a magnifying glass are either taken from flower or

bird life, or else borrowed from legends. They often appear naïve and mediaeval and have for the most part no perspective. Riders and horses appear to hover in vacant space; but it is just this naïveté, this almost childlike ignorance of proportion, that makes for the charm of the Kashmiri's work; each line is drawn with such delicacy and sureness of hand that many a European artist may well envy the simple craftsman. One well-known Kashmiri's designs are remarkable for their fine feeling for colour; his work is well executed, but his prices are tuned to the American buyer who, here as everywhere else in the East, to use a current expression, "spoils the market." This handicraft is passed on from father to son. Boys, hardly more than five or six years of age, practice under the guidance of an elder member of the family and learn the art of colour-mixing and



A POTTER AT WORK.

The potters work in the open, turning their clay upon an earthen wheel. With amazing alacrity, a beautiful vase or jug is fashioned within a few minutes.

brush handling, while the teacher is cosily enjoying his *narghile*, here and there instigating an idle pupil to work with his stick.

Kashmir embroidery is almost as famous as that of St. Gall. Of world-wide renown were the old shawls, wrought with such delicacy that each one of them cost one or more men their eyesight. The embroiderers and weavers were in reality slaves who, for a pay of a penny a day, worked in unhealthy, ill-ventilated places. In order that the industry might not spread to other parts, it was forbidden the men of the guild on pain of death to leave the country. It was not until the Franco-Prussian war, when Paris was no longer able to buy, that a stop was put to this state of things. It is said that Germany's victory robbed the poor shawl weavers of their last hope. Many heard of the German army's

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march into Paris with tears in their eyes, and thousands were left without work or bread. The shawl industry goes back to the time of the Mogul emperor Babar, who acquired from a weaver of Andishan (now situated in Russian Turkistan) a neckerchief in which one of his most precious gems was imitated. The sovereign was so highly pleased that he called a number of these weavers to his court, thereby starting a fashion, the remnants of which have been maintained down to the present day. The first shawls that came to Europe were brought by Napoleon from his Egyptian campaign as a present to the Empress Josephine, and the court-ladies vied with one another in the acquisition of fine specimens.

At the zenith of this industry, no less than thirty thousand artisans were employed in the manufacture of shawls, and the export before the Franco-Prussian

and now does nothing but make bad copies of the works of former artists.

With wood carving, things look somewhat better. The slender hands of artisans, crouching on the floor, form with primitive tools wonders of carving which, in the delicacy of their workmanship and artistic conception, will bear comparison with the work done in the Bernese Alps. There is, for instance, the magnificent smoking table at S. Subhana's, on which all the flowers of Kashmir are represented in their natural freshness; the cigarette box strewn with forget-me-nots is made of walnut. Folding tables and writing-desks form the main exhibits of these shops, which one seldom leaves without a considerable alleviation of one's purse. The windows and ceilings of the old Kashmir houses are worthy of special mention. The subtlest geometrical designs are formed of numerous carved staves and slabs; of these many find their way to European houses where they serve for artistic wainscoting, tables and chairs. Near the third bridge are the stone cutters who cut turquoises, lapis-lazuli and jade. Most of the precious and semi-precious stones come from Central Asia. Sapphires were formerly found in Kashmir, but it appears that the mines were exhausted long since. The pottery workers should not be overlooked; they work in the open, turning an earthen wheel on which lies a lump of clay. With amazing alacrity, a jug, pot or vase is formed within a few minutes, then laid out to dry in the house-yard before being put in the oven. The Kashmiri has inherited from his forefathers a distinct artistic sense, but here, as elsewhere in art, the Maecenas of olden times, who would lift an artist from the struggle for his daily bread to the throne of independent creation, are wanting.



COPPERSMITHS.

Although copper work is now an industry of lesser importance, delicate pieces of workmanship are still to be obtained at the fancy prices usually asked.

war amounted to fully half a million francs—in those days a considerable sum. At present, the embroideries are for the most part reproductions of old patterns or imported designs that are named after the lady who first ordered them. Thus we find, besides the platane leaf design in all possible shades, a Pocklington pattern that was brought from England years ago by a lady of this name. Men of all ages sit in dismal, ill-ventilated rooms, filling in with fine needle-pricks the ready traced designs in wool or silk. In a small adjoining room, little boys of four and five are being trained for whole days in finger exercises that facilitate their future labours. Besides table covers and bedspreads, cushions, tea cosies and ladies' underwear are now embroidered, but this decorative art, if one may so call it, is wanting in the enterprising impulse of creative spirit; it lives on the fame of past days



A YOUNG APPRENTICE.

The art of papier mâché work is passed on from father to son. Small boys practice colour-making under the guidance of craftsmen at a very early age.

In the Tree-Roof of the Guiana Forest.

By Major R. W. G. Hingston.

Leader of the Oxford University Expedition to British Guiana.

Following the publication of the official report, particular interest attaches to this first-hand account of the recent expedition to British Guiana. The author describes the hitherto unknown forms of life peculiar to the forest canopy, and shows how various species are distributed in a series of strata.

THE equatorial region, all round the world, is clothed in luxuriant forest, in Africa, Asia and America, and in many of the oceanic islands which lie close to the line. It is unlike the forests of the temperate regions; its trees are far stouter, tougher and higher and their trunks are straight, smooth and branchless. Quantities of orchids and epiphytes grow upon them and thick creepers bind them together. Long aerial roots hang from their summits and are either suspended freely like stalactites or secure a hold in the earth underneath. The tree-tops are not individually distinct; creepers and bushropes bind them into a kind of forest roof. It was this roof that we were particularly anxious to investigate; we believed it would yield much that was unknown. It was an area hitherto almost unexplored. Dr. Beebe, the American explorer of Guiana, who must often have turned his eyes longingly to that canopy, wrote, "Yet another continent of life remains to be discovered, not upon the earth, but a hundred to two hundred feet above it, extending over thousands of square miles of South America. At present we know almost nothing about it. Until now gravitation and tree-trunks swarming with ants have kept us at bay, and of the tree-top life we have obtained only unconnected facts and specimens. There awaits a rich harvest for the naturalist who overcomes the obstacles—gravitation, ants, thorns, rotting

trunks—and mounts to the summits of the jungle trees."

An expedition under the auspices of Oxford University decided to try and reach this canopy and to learn something of the life that existed in it. The site selected for this examination was a patch of primeval forest on the right bank of the Essequibo River about fifteen miles above Bartica. It was exactly the kind of forest that we wanted, for the vegetation was in its primitive unaltered state. The trees were in their natural associations, undisturbed by man's interference, and had existed for thousands of years with scarcely the slightest change. It was a forest composed of tall straight trees; some were monsters with broad buttressed bases which supported

the overhead roof like pillars. The vast majority, however, were of smaller size, and were crowded together in thousands, all struggling with one another in their efforts to get their heads into the tree roof. Every tree was perfectly straight; not one had a branch until it approached the canopy where, at a height of about seventy feet, it divided into a simple fork. Bushropes in every degree of thickness spread themselves about in this forest of straight poles. Some swung across in pendant loops, some hung down like loose cordage, and others twisted themselves round the great tree trunks in serpentine coils. Mosses, epiphytes, lichens, ferns crowded the trunks and



A FOREST LAKE IN GUIANA.

This photograph is typical of the forest scenery in Guiana. Orchids and other forest flowers grow in profusion upon the trunks of the trees.

high branches in the luxuriant confusion peculiar to the tropics. Overhead, the tree-tops made a green roof, while the fallen vegetation covered the floor with a thick soft carpet of mould.

Throughout the forest were glittering lights, bright spots, streaks and luminous patches, where shafts of sunlight broke through the roof and illuminated the underlying foliage, which reflected them like sheets of glass: it often looked as if a multitude of mirrors were suspended in the vista of green. On every side was the richest fertility, and in the prostrate trunks and rotting leaf-mould was equal evidence of death and decay. The silence, the gloom, the stillness and the luxuriance were the most impressive features of the place. Having cleared a large area in the midst of this solitude, we established a fairly comfortable camp. A week was spent in preliminary operations and we were then ready for our main objective, the study of the canopy life. I was surprised to find that the roof above us was not as complete as I had expected; it could not be compared with the roof of a house. There was, of course, a thick layer of interlacing creepers, but the sky was not everywhere hidden. Here and there were windows, skylights in the canopy, through which the sunlight streamed to illuminate the underlying floor. The average height of this canopy was about a hundred feet. Through the deep gloom of the underlying forest we could see just enough into the roof to assure us that it must contain a quantity of life. Monkeys could be seen leaping through it, birds were heard twittering there, and occasionally a huge and beautifully coloured butterfly might be detected at some tree-top flower. In order to get easy access to the canopy, we had brought out with us an assortment of climbing apparatus. We had little or no previous experience, so we thought it the wisest plan to be prepared for climbing by different methods; if one method failed, another might prove satisfactory. We had with us a rocket-firing apparatus and a line-throwing gun which we hoped would be of use in shooting ropes over the highest branches.



SPRAYING THE TREES.

The high trees are infested with an endless variety of insects, and syringes were an essential part of the equipment.

The equipment included two thousand feet of rope for hauling ourselves up and suitable pulleys for making blocks-and-tackles, a Royal Air Force parachute sling, rope ladders for spreading in the canopy, and iron bars for making spike ladders up the tree-trunks. A part of the equipment, which we were assured would be absolutely essential, was syringes for shooting poisons at the insects said to infest the high trees. But more valuable to us than our miscellaneous equipment was the assistance that we obtained from Indians who were accustomed to scale the biggest trees in the forest. In different ways, with the help of this apparatus, observation posts were established in the canopy. One method

was for an Indian with spikes on his boots, and a circle of rope round both his body and the tree-trunk, to climb to the first fork at a height of about seventy-five feet. He would carry with him a light line and pass it through the fork. One end of a block-and-tackle would then be hauled up and attached to the first fork. To the lower end of the tackle a chair would be fastened, made out of wood from ration boxes, and in this chair one could be hauled to the upper point of fixation in the tree. Then the tackle would gradually be moved higher and higher until the most suitable position for observation was reached.

Our original intention was to build observation platforms in the branches, but these improvised chairs proved to be so satisfactory that we kept them for permanent look-out posts. Indeed, so comfortable were they that whole nights could be spent in them. We were able to fix observation posts on the highest trees, which pushed their branches above the level of the canopy; and this enabled us to look down on the canopy and study it from above. Other trees were climbed with the help of rope-ladders. The first fork was reached by scaling the trunk with the help of a circle of rope round one's body, and a rope-ladder was then hauled up. Its upper end was fixed to the fork and its lower end was hauled out so that it inclined against the tree-trunk like the shrouds against the

mast of a ship. The lower end was then anchored to the ground and access was opened to the first fork. This arrangement worked fairly well; but the ladder had a habit of swinging about and sometimes twisting completely round, which was somewhat disconcerting when one was about half-way up.

This trouble was overcome by fixing guy-ropes to the ladder and anchoring them to convenient trees. Having reached the fork by means of the ladder, we wished to make the canopy sufficiently accessible to permit us to move into different parts of it. This was achieved by spreading vertical rope-ladders from one fork to the fork above it, and by arranging horizontal ones on either side. This was strenuous work in the hot moist climate, but it fully repaid us for a great deal of trouble. We were able to scramble about on the ladders which led us from one part of the tree to another, and in this way to collect the miscellaneous creatures which daily visited our area of the roof. The largest tree ascended was known as a Baramalli. It was 150 feet high and so tall that not only did it reach the canopy but pushed its head about forty feet above it. A point of fixation was secured at 120 feet, and swinging in a chair at one end of a block-

and-tackle, one could be hauled up to this point. From there, a very fine view was available over the top of the forest roof. To the south particularly the outlook was unobstructed, and one could take in six to eight square miles of canopy. The roof, viewed from this point of vantage, had the appearance of a vast plain, not indeed a level plain, but a rather undulating surface with many elevations and depressions in accordance with the varying levels of the ground and the different heights of the trees. There was a variety of colour on the top of the roof; every shade of green was represented, and there were numerous flowers of many colours, some purple, others pink, white and red. Everything sparkled in bright sunshine, and in marked contrast to the gloomy and flowerless forest underneath.

Our business was both to make observations on the life of the canopy and to accumulate collections of the creatures that inhabited it. The observations were made mainly from the perches. They were specially useful for bird investigations, and every hour of the day and night is represented in the ornithological record. Animals were collected by setting snap-traps for them in the branches, or by sweeping the foliage with nets attached to long handles. Dead animals were placed in forks of the trees in order

to attract the flesh-eating species, and vessels containing water were placed there for those with aquatic tastes. We devised a series of automatic insect traps which had the appearance of large muslin cages; these were hauled nightly into the canopy with lamps suspended inside them. On dark nights they caught numerous tree-roof insects and must have added thousands to our collection. During the day we used to bait them with meat or syrup, or the sweet sap from tree trunks. In this way we secured several specimens which otherwise we should never have met with. They were particularly useful in studying the layers of life in the forest. We set the traps at different elevations; one, for instance, at a hundred

feet, another at eighty feet, a third at sixty feet, and we were constantly surprised at the difference in the catches, which indicated how the animal life of the forest is spread in successive layers. Altogether, we secured an adequate sample of the life of our forest patch. We secured 75 mammals, 166 birds, 207 reptiles, 10,000 insects, 5,000 sets of plants, and 500 miscellaneous finds.

The most striking feature of the Guiana forest is the profusion and variety of the life encountered, especially plants, birds and insects. Mammals, on the contrary, are not very noticeable. Several kinds of monkeys used to frequent the canopy, and tapirs, deer, armadillos, sloths and alligators were met with and collected in the vicinity of our camp. The paca and agouti were the animals of which we saw most. They are the rodents of the South American forests



SHOOTING THE LINE.

The problem of scaling the trees was overcome by the use of a gun from which ropes were shot over the highest branches.

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and were for us the chief supply of animal food. Squirrels used to come into our camp, and we were also visited by little ground rats with stiff spines intermingled with their soft fur. A delightful capture was a pure white bat, which used to hang by day under the leaves of the Turu palm where it blended with their silvery tints. The birds of the forest were impressive both in their brilliancy of plumage and loudness of voice. Whole groups of them, including parrots, toucans, macaws, cotingas, flycatchers, and humming-birds remained perpetually in the tree canopy and never descend to the ground. At morning and evening there used to fly over our camp flocks of green parrots and crimson macaws uttering loud cries. A bird known as the Greenheart uttered a peculiarly penetrating, high-pitched whistle; the toucans made repeated yelping notes, the caracara a screaming cackle, the banish a turkey-like gobble, and the wood-rail a scream like a moribund dog. Indeed, noises of every conceivable kind broke the silence of the forest at almost any hour of the day or night. There was the ringing, rattling and sometimes roaring of frogs, the bellowing of the howling-monkeys, the shrill chirpings of grasshoppers, the siren whistles of cicadas, and the tweetings of bats. Although at times the soundlessness of the forest was impressive, continually some strange note would unexpectedly break the stillness. There was always a hush during the two hours that preceded dawn.

Insects abound in the equatorial forests; their variety would seem to be endless, and it is impossible



SCALING THE TREES.

After the ropes had been shot, the Indians who assisted the expedition climbed to the top of the trees in spiked boots in order to adjust the pulleys.



AT THE TOP.

The final stage in climbing to the canopy was the fixing of "observation chairs" in the topmost branches, which were hauled up by means of pulleys.

to convey any true idea of them. Very large collections were secured, and those from the tree-tops are likely to result in the discovery of many new kinds. We met with many forms of mimicking insects, that is to say, creatures which adopt the guise of some other object in order to enable them to escape an enemy. For example, we came across different kinds of moths which in appearance were so like wasps that we hesitated to touch them for fear of getting stung. We met with certain butterflies which would have been relished by the birds were they not so exactly the image of nauseous kinds that the birds were deceived and afraid to go after them. Harmless spiders were shaped like poisonous ants, which no insectivorous animal will touch, and there were certain caterpillars which appeared to be innocent enough. But the moment one approached them, they underwent a transformation, and by distending themselves and exposing eye-like markings became the image of the poisonous snakes which lived habitually among the leaves. Certain spiders adopted extraordinarily ingenious methods of escaping the enemies which were always in search of them. One species hung little pellets in its web, the same shape as itself, which had the effect of decoying the enemy.

Some of the great trees were most arresting. The roots of the stilted tree, or *Awasakuli*, rose into the air clear of the ground. They then inclined to one another like a conical cage, on the apex of which stood the tall straight trunk. In this way, the tree gained a broad base which must have helped to stabilize

it and to give it strength. Another striking kind was the fluted tree, or *Yururu*, from which our men made their axe-handles. The whole length of its trunk was chiselled into long grooves, and the tree looked as if a number of saplings had been compressed together into a common trunk. It is probable that strength was secured by this means, after the manner in which a fishing-rod is strengthened by being composed of a number of longitudinal pieces.

Perhaps the most striking of all the trees was the *Mora*, one of the buttressed group. Its immense trunk was formed of flat buttresses, perpendicular projections six feet or more in height, which often followed a sinuous course before they reached the ground. This must clearly have had a strengthening effect, in the same way as our masonry columns are strengthened by standing on an expanded base. The bush-ropes that bound the huge trunks together existed in all kinds of peculiar shapes. There was one type known as the monkey's ladder which was shaped into an alternation of hollows and elevations, giving it the appearance of a vertical ladder let down to permit the denizens of the ground to ascend into the overhead roof. Another was twisted with such perfect regularity that one could scarcely tell the difference between it and a rope.

Discomforts of the Forest.

There were, of course, certain discomforts in the forest. Our chief trouble came from damp and pests. During the wet season the air was constantly saturated, heavy rain fell daily, and the forest foliage never ceased to drip. A visit to the bush meant getting soaked to the skin. Nothing dried in the humid atmosphere, and one got used to starting off each day in the wet clothes of the evening before. A harvest mite used to burrow in the skin covering one with red irritating spots. Ticks attached themselves by a sharp proboscis, making wounds which were liable to develop into painful boils. Mosquitoes played their usual part in the darkest and swampest places.

There is little doubt that the canopy of the equatorial forests is an area well worth the most detailed exploration. The life inhabiting it is quite different from that on the ground and in the intermediate forest levels. It is a field abounding in animal existence, of which we have at present only a fragment of knowledge. In the small area that came under our examination we secured some thousands of specimens, but this is merely a drop in the ocean compared with the immensity that remains to be investigated. A point which came out

Correspondence.

BIRDS OF THE NORTH ATLANTIC. To the Editor of DISCOVERY.

SIR,

I should like to correct a small and obvious mistake in my article on North Atlantic birds in the November number of *Discovery*. There is a sentence on page 362 which has been altered by a proof-reader so that it no longer means what it says. It is as follows: "The other land birds, except one, were all waders; I think the exception was the golden plover." This was originally worded: "The other land birds were all waders, and all except one were, I think, golden plovers," which restores some meaning to the rest of the paragraph, although the literary style is possibly less elegant.

Yours faithfully,
V. C. WYNNE-EDWARDS.

McGill University,
Montreal.

[Unfortunately, Mr. Wynne-Edwards omitted the comma and the word "and" after waders, and the meaning of the sentence as it originally stood was, therefore, somewhat obscure.—Ed., *Discovery*.]

FROM A READER IN ASSAM. To the Editor of DISCOVERY.

SIR,

I have been a subscriber to *Discovery* for some years; in fact, I have read and enjoyed it from the very first number. May I take this opportunity of wishing so excellent a publication long continued success. Seeing things from afar as I do, I should imagine the times are against you just now; if they are, I have every hope, and indeed belief, that *Discovery* will tide over the time of difficulty. The journal is essential to readers like me, with no specialized knowledge, but anxious to be kept in touch with what is going on in the scientific and literary worlds, and I am grateful that *Discovery* provides me with that opportunity.

Yours faithfully,

Cinnamara,
Assam.

THOS. SEFTON.

(Continued from previous column.)

clearly in our explorations was the fact that the life of these equatorial forests is spread out in a series of strata. We must think of the life of the forest in much the same way as we think of life in the ocean, that is to say, not merely at the top and at the bottom, but spread through the vertical depth, with different forms of life at various depths. In these layers there will, of course, be much overlapping, but, on the whole, it will be found that numerous species, and no doubt large and complex communities, are distributed in these horizontal layers. It is a subject of which we at present know little or nothing, but one day the forest will be investigated from this standpoint; it will be examined systematically, level above level, and a record will be taken of how life changes in successive layers.

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An Opponent of St. Joan.

By B. J. H. Rowe, M.A., B.Litt.

New attention has been focussed on the beautiful manuscript known as the Bedford Hours, recently secured for the nation at a cost of £33,000, and the acquisition recalls the life of its original owner. Although the prominent part played by John, Duke of Bedford, in mediaeval English politics is well known, the importance of his career as English Regent of France is not generally recognized by modern historians.

THE acquisition of the Bedford Hours is a matter for public congratulation, for the manuscript is a work of great beauty and it was prepared for and owned by one of the greatest of mediaeval Englishmen, John, Duke of Bedford, third son of Henry IV. The dividing line in Bedford's life was the night of 31st August, 1422, when his brother, Henry V, died in the Castle of Vincennes, near Paris. "I beseech you," said the dying man to his brother, "by all the loyalty and love which you have had towards me, that you will always be true and loyal to my son Henry, your nephew"; and Bedford consecrated his life to the fulfilment of this charge. But for his nine months old nephew, then Henry VI, Bedford himself would have been king, but there is no sign that he grudged the child his throne. He was no Richard III. Among the greedy and ambitious nobles whose intrigues characterized the so-called "reign" of Henry VI, Bedford alone put public service first, and never wavered in his loyal devotion to the young king. As Warden of the East March, he had already served a long apprenticeship in statesmanship on the Scottish border, and had afterwards proved himself an able ruler when left to govern England during his brother's absence in France; but after 1422 he had only one aim: to preserve to the boy king the French crown, which the victor of Agincourt had won for his son and with his last breath had committed to Bedford's keeping. The task demanded all his energies and England, to her loss, saw little of him.

An Example in High Places.

In 1425, he came hot-foot from Paris to compose the strife between Gloucester and Beaufort, lest England should go the way of faction-riven France, and for a generation the Wars of the Roses were postponed. Some years later, he appeared again to collect men and money for the wars in France. He set an example in high places by suggesting a large reduction of his own salary and by offering his personal revenues for the royal service. The faithful Commons petitioned that he should remain in England, for he seemed the one man capable of stopping the rot which was setting

in at court. But the work in France claimed him. Back he went to spend himself for a few months longer in his barren and hopeless cause, and to die at Rouen in September, 1435, with the death knell of the English hopes ringing in his ears as his ally Philip of Burgundy concluded at Arras a final treaty with the enemy he had fought so long, Charles, the Dauphin. Bedford is thus remembered primarily as the man who maintained the English domination in France during the thirteen years following the death of Henry V.

"Well Loved" by the French.

Twentieth-century historians are inclined to look askance at the Duke of Bedford's activities in France, for his government in the north meant the conduct of a civil war in the interests of a foreign king. The figure of St. Joan blots him from our sympathies: her martyrdom is a sufficient condemnation of his cause. It is easy, perhaps, to condemn him across five centuries of human experience, but in the fifteenth century, as Mr. Bernard Shaw has shown, humanity was only painfully learning to recognize and understand the spirit of nationality. No one clamoured more loudly for the death of Joan of Arc than the French scholars of the University of Paris, and the judges who condemned her to the stake were French. The props of the English power in France were public-spirited Frenchmen, learned and liberal ecclesiastics like Louis of Luxembourg and Pierre Cauchon, and this was not because such men were greedy time-servers who had sold themselves to the enemy, but because to them "the enemy" meant not the English but the Armagnacs and their protégé the Dauphin, their bitter foes long before Henry V ever set foot in France.

It is no marvel that Bedford accepted without apparent question the justice of his cause, but it is remarkable that he ruled Northern France in such fashion that, in the words of a contemporary, "he was well loved by the French of his party." His appearance was impressive and his personality inspired affection. Six foot tall, and vigorous in true

Plantagenet style, he wielded a battle-axe with valorous dexterity, and his great victory of Verneuil was considered by some a more notable feat even than Agincourt itself. It saved the north from the Armagnac menace, and on his return to Paris the people received him "as though he were God." Year by year he prosecuted the war with tireless energy, believing that his sword could "drive war out of the kingdom and establish peace and tranquillity, to the honour and service of God and the maintenance of merchandise and labour." So, despite his constant soldiering, a Parisian could write of him that the Duke of Bedford "desired war with no man," contrasting him with the rest of the English "whose nature it is always to be wanting causeless war with their neighbours."

An Enemy's Tribute.

"Strenuous, humane and just" was the whole-hearted tribute of Thomas Bastin, historian of his enemy Charles of Valois, while the astute Philip of Burgundy recognized in him "a prince who would seek always to judge righteously"; and he was content to let him arbitrate in his quarrel with Gloucester. But it was to Normandy that Bedford gave his closest personal attention, for Normandy was the heart of the English power and the ancient patrimony of his race. The Norman chronicler speaks of him with great affection as "our Regent of Normandy, noble by lineage and in virtue, wise, generous, feared and loved."

Bedford was himself a man of strong personal affections. His love for his brother proved the guiding factor of his life. His love for his first wife, Anne of Burgundy, was a matter of public comment; occasional references show us her love for him. He was a liberal benefactor to the Cathedral of Rouen, and in 1430 was made canon of the cathedral. The ceremony was prolonged and included a sermon. Bedford had been ill—he was still too weak to stand the weight of his canon's gown—and he seated himself to listen: at a little distance knelt the Duchess, "watching him with solicitude." Those who served him and his cause did so through good and ill with a loyal devotion which wins respect both for them and for him. The same names occur year after year in the records of his administration, moving steadily in promotion and giving an impression of stability very striking in the records of an alien domination. Long after his death, when Rouen had passed back to the Valois and feeling ran high against the English, the Cathedral canons still marked their respect for his memory on the anniversary of his death by

uncovering the magnificent tomb which they had raised to him, "that Christians seeing his effigy might recommend his soul to God." The effigy has long since disappeared and the tomb, after many vicissitudes, is now marked only by a small plain stone in the floor of the chancel.

Together with the Plantagenet length of limb, Bedford seems to have inherited something of the Plantagenet temper, and his anger was formidable. When the lawyers of the Parlement of Paris passed a resolution to suspend the session until the arrears of their wages were paid, not one could be found bold enough to announce their decision to the Regent, and the session was meekly continued. That such a message would have provoked an angry outburst is likely, for Bedford, just back with shattered health from the disastrous siege of Lagny, had granted the lawyers interview upon interview, and only a few days before had sat with them "by the dove-cote in his garden" patiently explaining to them for the hundredth time the financial difficulties of the government, which even the sacrifice of the greater part of his personal revenues did little to help. Like many another governor, Bedford was paralyzed by lack of money, the more maddening because an unpaid soldiery would take to plunder. This, true to the tradition of Henry V, he was determined to prevent. Later commanders in France appropriated grants for the army to their private use, but Bedford not only kept his hands clean, but eked out the public monies from his personal revenues and pledged his own plate and jewels to secure a loan from which to pay the soldiers. It is not till after his death that lack of pay is spoken of as a frequent cause of disorder in the English army.

His Greatest Achievement.

The French, used to the ravages of Burgundian and Armagnac soldiers of fortune, had hailed the disciplined army of Henry V as a marvel. Bedford was as great a disciplinarian as his brother. The problem was most acute in Normandy, which was garrisoned by an English army of occupation. Under Bedford, a system was evolved which ensured that, contrary to fifteenth century practice, the soldiers should not live upon the people. It included regular enquiries by local French officials into the behaviour of the soldiers, and in one district, the peasantry and tradesmen bore witness that the garrison were "of good life, condition and government, loyally paying for the goods they took," and in another that they "lived like simple country folk, paying their way without seizing or extracting anything

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from the people." To have secured this was perhaps Bedford's greatest achievement.

There was a danger also lest free companies should develop such as ravaged the rest of France in the name of Charles VII, but Bedford had a short way with free-booters. Only one Englishman, Richard Venables, attempted the career of a free-lance captain during Bedford's lifetime, and he was seized and publicly executed as a thief and a traitor. But although Normandy was admittedly more prosperous than the rest of France, there was a great deal of plundering by stray men-at-arms and armies on the march, and still more by brigands, whether political outlaws or mere bandits. Bedford kept them more or less in check by ceaseless vigilance and continual executions, but the countryside went from bad to worse as time went on, and after his death all pretence at order came to an end.

The story of the Wars is a dreary tale of sieges and executions, but Bedford's government had another side. Henry had offended the French by his pride; he could not forget that he was a conqueror. Bedford inaugurated a new policy, and from the beginning he put aside his natural English bias and, identifying himself with the French people whom he was to govern, proved himself an enlightened ruler. He abandoned Henry's attempt at settling English colonies in French towns, and was sparing in his grants of land or ecclesiastical preferment to his own countrymen. Outside Normandy, he ruled through the Burgundian partisans and in accordance with the principles for which they had stood. No change was made in governmental machinery and not a single office was given to an Englishman. In Normandy, the chief officer of each district, the *bailli*, was always English, otherwise the administrative personnel was almost entirely French, and this local bureaucracy was encouraged to collect local opinion and to co-operate in the business of government. He studied Norman institutions and revived the seneschalship in accordance with the terms of the Norman costumier. He revived also the Exchequer and, most important of all, the moribund Norman estates.

A Patron of Art.

A soldier and statesman of outstanding ability, Bedford was also a patron of learning and of art. He was the virtual founder of the University of Caen, and Oxford recognized in him at least a would-be patron. France suffered by his zeal for letters, for he took possession of the royal library at a low price and when Paris was threatened by the Dauphin in 1429 had the books transferred to Rouen, whence,

after his death, they disappeared. Possibly they passed into the keeping of Duke Humphrey, and perhaps this helps to account for the liberality of Humphrey's gifts to Oxford in 1439 and 1444.

Unlike Humphrey, Bedford took no interest in Italian learning; his outlook was conventionally mediaeval. St. Joan horrified him by her unorthodoxy, and without compunction he described her as "a disciple and limb of the fiend," blaming Charles VII for using her "to deceive the simple people." Her success, he was convinced, could be due only to "false enchantment and sorcery" coupled with a lack of belief on the part of the English; for he was sincere in his religion. When first he entered Paris as Regent on 5th November, 1422, he halted his cavalcade at the door of Notre Dame and entered the church to pray. He delighted in the services of the church and was liberal in his gifts. It is natural, then, that both in France and in England he should have been a patron of the illuminator's art, and that some of the most beautiful fifteenth century manuscripts in existence were prepared for his use.

The Bedford Hours.

One example only of work prepared for him by English artists has survived: the Bedford Hours, lately rescued from the risk of exile to America. Its exceptional beauty, its unique gallery of portraits, the delicacy of its borders, and its importance in the history of English art have been described elsewhere. For Bedford himself it may well have had a special interest, for his chapel was ordered after the English fashion, and by special papal permission he followed the English Use of Sarum; quite possibly his English Horae was in daily use, for exiled in France, his thoughts still turned to England. In the Book of Hours executed for him in Paris, he is represented on his knees with St. George beside him, and although his councillors and ministers were French, his personal attendants were all English. The beautiful breviary according to the Use of Sarum, prepared under his orders by French artists, was decorated with English saints and heroes, to remind him of his own manor of Canford and the Dorset hills.

The Parisians had at first regarded Bedford as a foreign interloper. At the funeral of Charles VI he paced alone behind the bier, a sombre stranger, and there were angry murmurs in the streets as he returned to the palace. But before his death, he could write that he had found his alien subjects "as loving and kind as ever were people." Had he been called to the throne, he must have proved himself one of the greatest of our kings.

The Rise of the Post-War States.

By J. E. Pryde-Hughes, F.R.A.I.

The remarkable rise of the new states created by the Peace Treaty is clearly shown by their architecture, which has developed on original lines. Many parts of Europe have been reconstructed in the past ten years, and their economic position to-day is reviewed by the author, who has recently travelled in these countries.

PROOF that decentralization and the recognition of nationalism has been beneficial to the people of the new states in Europe is visible on all sides; in the growth of capital towns, in new constructional work, in art and in the renewed activities of the inhabitants. When these new countries were neglected corners within greater states the individuality of the people was repressed, and their national genius had no outlet; now they have something to work for — themselves. The evidence is particularly obvious in and about Prague, and in the new Baltic countries.

In discussing the progress of the new states, reference must be made to the old states, now reduced in area or enlarged—Germany, Austria, Hungary, Rumania, Serbia and Russia. Within the scope of a short article only the more obvious signs and changes can be touched upon. Germany since the war is very important, for her architects in particular have shown considerable ingenuity in evolving new styles, and much courage in modern construction. The accompanying photograph shows an example of the many and varied uses of concrete. In this direction Germany's influence in surrounding states has been prominent, and in other ways, too, her example has been followed.

We may start our survey at the top of the map of Europe. Finland has struggled bravely out of the slough of Russian indifference, though she is still retarded by fear of her former master and present

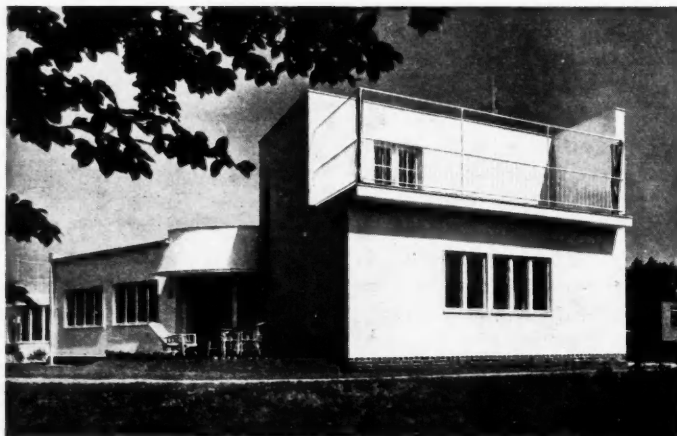
uncomfortable neighbour. While industry and trade claims more workers than ever, the development of the land has not fallen behind, and agriculture has held its own. The population of the capital,

Helsingfors, was 198,000 in 1920, and ten years later it has grown to more than 221,000. As the population and industries have increased, the social services have developed on modern lines. The big towns are extending their boundaries and are building fine architectural monuments in which Scandinavian, German, and especially Swedish

influence is noticeable, though there is a firmly established school of modern Finnish architecture. Apart from municipal and state enterprises there has been a great deal of private building. In the capital, about 20,000 rooms have been added to the available accommodation in the past few years.

Finland's neighbour, Sweden, is in a very interesting transition period with regard to architecture. It may be said that with the completion of the Town Hall at Stockholm a distinct epoch was closed, and that to-day, after an attempt to copy American sky-scrappers, the Swedish architects are vigorously supporting an entirely fresh style which ignores national traditions and favours a new expression in social, economic and technical design.

Across the Baltic, in the new "independent sovereign Republic" of Estonia, which in the past was deeply affected by Swedish culture, the astonishing results of a national spirit released from bondage are



GERMANY.

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everywhere revealed. While repressed by their Russian rulers, the Estonians had no opportunity in their own country, and educated men seeking advancement in the civil and military services had to consent to practical exile in distant parts of the Russian Empire. The wonder is that after so many years under such conditions the Estonians have been able, in the few years of their independence, to rise so clearly from insignificance to the effective position they hold to-day. In literature, the theatre, fine arts and education, decided advances have been made. Almost every individual over ten years of age receives free education, and the ratio of university students is now the highest in the world.

The land reform law of 1919 has had fruitful results, and the increase of cultivated land has been no less than 20 per cent. The production of food crops has grown proportionately and dairy farming also shows very marked improvement. This progress is also reflected in the trade figures, and from Tallinn, Estonia's chief port, the exports are now five times larger than in 1914. Under the Russian government Tallinn was a naval base, but under the Estonian Republic it has become the country's main commercial port. In considering the increase of business, it should be borne in mind that before the war Russia was almost the sole purchaser of Estonian goods. With the advent of the Soviets' policy this trade broke down entirely, and the republic has had to turn attention to the western markets. Great Britain is now her best customer, and the chief exports are dairy produce and wood products. The latest available data give the population of Estonia as 1,116,000. Although the people are more than ever engaged in agricultural pursuits, the capital is growing



ESTONIA.

The new theatre at Tallinn (Reval) with the market-place behind, photographed from an aeroplane.



LITHUANIA.

General view of Kaunas, the provisional capital of the republic, showing the large blocks of flats characteristic of the city.

in size, and its fine new buildings testify to the revived spirit of the country.

Post-war improvements are also visible in Latvia and Lithuania, where housing difficulties have encouraged, as in other countries, the building of many big blocks of flats. Lithuania is still irritated over the Vilna problem, and when one comes to deal with statistics this question is always prominent. If the irritation against their more powerful neighbours were allayed, progress would be more definite and sure. A great deal has been written about these adjoining countries. Poland has shown a bold front to progress since the war, though there are disturbing elements in her position. Soviet Russia, despite the relapse into semi-barbarism in frequent directions, has advanced energetically in industrial construction and modern architecture. Indeed, so splendid has been the improvement in isolated instances, that one must regret the failure to apply this energy to the general welfare. The return to the capital towns shows a strong upward tendency. Moscow in 1920 had 1,027,330 citizens, and on 1st January, 1930, there were 2,412,300. The figures for Leningrad show a similar increase.

It is when our survey reaches Czecho-Slovakia that the real meaning of national progress is realized. In that newly established land the work of reconstruction has been attacked with almost ferocious intensity in all directions. Industry has gone ahead by leaps and bounds, and at the same time the old spas have been restored to the former glories which they enjoyed under Germany and Austria. Many insignificant health resorts have been likewise re-modelled and made effective and attractive. These health and holiday centres in Czecho-Slovakia are important

features of her new industry, for they lead the way in architectural progress, and attract many visitors who spend money in the country on native manufactures and products.

Here, as elsewhere, one of the most difficult post-war questions was that of housing, but this has been largely solved. Prague, the capital—of which Vienna was jealous in the days of the dual monarchy—caused a tremendous strain on the new country's resources when it commenced to expand. In 1918 the population was 663,000, and this year the inhabitants are estimated at 780,000. In addition, there is a constant flow of visitors through the city, as the tourist traffic is very active. In 1921 Prague had 19,044 houses, and at the end of 1927 there were 26,260. New hotels to accommodate business travellers and holiday visitors, as well as official buildings, shops and factories, have also arisen under the building impulse. The architecture is typical of the modern spirit in its restrained and less extravagant moods, and the new villa suburbs are attractive examples of what can be done under a judicious town-planning scheme when space is available. In the provincial towns the same signs of development are apparent, and factory accommodation has increased at an equal rate. With its fourteen million inhabitants, Czecho-Slovakia is rather larger in area than England (without Wales). The economic stability is exceptional, and the natural wealth of the country is increased by the character of the people, who are hard-working and thrifty.

Austria, to-day, might almost be called a post-war country, since in her greatly reduced state the conditions

are utterly changed. The total area is only 83,843 square kilometres, as against 676,061 under the old monarchy; and the population is under seven millions as compared with fifty millions. For several years after the war there was heavy depression in the country, but as things gradually returned to normal, trade improved and a period of development set in. Austria and the capital, Vienna, are well placed to act as a market for Central Europe, while the beauty of the country and facilities for excursions attract thousands of foreign visitors whose numbers continue to increase. Social development, education and art have followed the natural line of progress, and after a very bad period the capital is rapidly reviving, again taking its place amongst the great urban centres of Europe. The housing question has been serious, and especially interesting are the new tenement houses—huge blocks of distinctive architecture, with garden amenities that compare very favourably with those in other countries.

One might also call Hungary a post-war country, though Hungarians with their thousand-year-old European tradition would probably resent this description. The land has lost much as a result of the peace treaty, but it has gained in that to-day it stands free and independent, its identity no longer lost in that of its once great neighbour. The war, and the events following it, has had a great influence on the development of the Hungarian capital. The war years paralyzed the activities which, since the union of the three towns of Buda, Pest and Obuda in 1879, had gradually changed the old capital into a



CZECHO-SLOVAKIA.

The municipal museum at Kralove Hradek, a fine specimen of modern Czech architecture. It was designed and built by Jan Kotera.



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VIENNA.

New municipal flats in the Marx Strasse, officially opened in October.

modern spa. The revolution in 1918, Bolshevik rule, and finally the country's great territorial losses retarded for a while the progress of rebuilding and development. Great cities depend largely on the country surrounding them, which acts as a sort of economic background. This influence was important in Hungary, where the enormous and rapid economic growth of the country gave impetus to their development in the last decades of the nineteenth century.

The Peace Treaty of Trianon took away 71 per cent of the land of pre-war Hungary, and 63 per cent of her former population. These facts naturally had their effect on Budapest, since the centre of a country of twenty-one millions of inhabitants now became that of a country of seven millions. The census of 1917 showed Budapest to have a population of 961,000 against the 880,000 in 1910. Then the population began to fall, for after the war the people returned to the country to resume their old occupations. The census of 1920 showed considerably lower figures, in spite of the fact that a large number of refugees from the lopped-off territories had settled in Budapest. Later the population began to grow again, and to-day it is round about one million.

There were two boom periods in the building of Budapest: one of them in 1890, the other between 1910 and 1912. In both periods the movement culminated in the building of about 10,000 dwellings a year. The fact that this activity showed a relapse just before the war was the result of economic depression. Although there was a great demand for flats and rooms in the period following the war, very few houses were built until 1924, owing to the lack of capital and the low rents offered to the owners, due to the restriction of business in real estate. The movement started with Government subsidies. This

activity culminated in 1928, when 1,039 new houses were completed in Budapest. The majority of these houses were small, without an upper story, a design typical of the Hungarian family house. From the standpoint of public health and social development this system has the advantage over the crowded blocks of flats. Nearly 27,000 houses were built between 1919 and 1929.

The commerce of Budapest suffered greatly from the changed conditions of the post-war years. The main reasons for these conditions were the inflation of currency, followed by rising prices and their consequent limitation by law. There were also difficulties of export and import, due to fewer consumers in the smaller territories. In 1928 there were 1,208 factories in Budapest, about a third of the 3,414 factories now operating in Hungary. This development was not, however, the result of a general improvement in every industry. The factories supported by the raw material of pre-war Hungary and those which produced chiefly for export, such as flour mills, suffered heavily under the altered conditions. The quantity of flour produced by the great mills at Budapest sank to one-sixth of its pre-war volume.

The factors which affected Budapest had an influence on other large Hungarian towns, but during the last few years there have been signs of modern progress. Szeged, Pecs and Debreczen, the shores of Lake Balaton, as well as the capital, now have fine new buildings, better accommodation for all classes, and increased facilities for education, art and sport. The present fathers of Budapest are wide awake to the possibilities of this beautiful city as a health resort, and are steadily improving the amenities of the town, which to-day offers the visitor every facility for "cures," spa accommodation, sport and pleasure.



PRAGUE.

Tenement house at Bubeneč, Prague, typical of modern Czech architecture

The banks of the Danube are becoming as fashionable as the best Riviera resorts. The new and revived resorts of the Buda hills offer every refined entertainment, and the general aspect is one of a modern very up-to-date spa, the conditions being equal to those of other leading resorts on the continent.

It is a very short journey nowadays to the frontiers of Yugo-Slavia, and to the capital of that country, Belgrade. Enormous changes have taken place in the land of Serbs and Croats since the war, and one has only to pay a passing visit to Belgrade to realize it. The progress of the capital is reflected throughout the country, and the Dalmatian watering places, for example, are advancing to a foremost position. Since 1918 the population of Belgrade has trebled. In 1918 there were 95,000 citizens, in 1921, about 111,000, and at the present time this figure has increased to 230,000. Building has gone hand in hand with the increase of inhabitants, and as elsewhere business and municipal construction has been very active. Modern French influence is very evident in Belgrade and in the surrounding country, but the Serbs have their own sturdy native ideas, which are finding expression not only in architecture but also in trade and industry. The "peasant" conception of Yugo-Slavia must now be disregarded, for the Serbs and Croats are taking a greater part in world affairs and their capital has become an influential banking centre.

In Bulgaria the development has not been spectacular, but there has been a distinct advance which seems likely to continue steadily. In 1926 Sofia had 250,000 inhabitants; by now it must be approaching 300,000. Among the new buildings of the capital are the Sofia County Council's offices, the new headquarters of the architects and engineers, and a large number of huge private dwellings built co-operatively. Some of these buildings are up to seven storeys high and are spread all over the city. Trade and commerce are growing steadily, and although there are many backward elements in the country the new outlook is hopeful.

Across the Danube, in Rumania, rebuilding on a

large scale is of quite recent date. The old kingdom comprised the geographical divisions of Moldavia, Wallachia and the Dobrudja, with an area of 50,260 square miles. The total area of Greater Rumania to-day is more than double, and covers 113,900 square miles. It is naturally a great agricultural country, and nearly twice as much land is put down to cereals now, as compared with the position before the war. The exports are, however, smaller in quantity, as under the land reform laws the peasant farming is somewhat haphazard and there is a greater consumption of wheat per head in the country itself. Another cause is the lack of an efficient transport system, but the Government are undertaking road construction and are developing the railways.

In the urban centres, ambitious schemes of rebuilding and extension are being effected. The capital, Bucharest, not long ago a rather unkempt town, will in a few years time become a very modern city, with high business buildings and broad boulevards and avenues. New suburban areas are being developed on the out-

skirts of the city. Similar progress is visible in Galatz, the bustling grain port on the Danube, and in Braila nearby, while old resorts like Constantza, and new places like Sinaia in the Transylvanian foothills, are now provided with every modern comfort.

Out of the turmoil of the past there has been bred a new spirit, and its influence will expand presently throughout the whole of Europe. At present, as particularly seen in architecture and building, ideas may appear to come from the older countries like Germany, but already the native genius is peeping through, and, even where concrete is the medium employed, the moulding becomes more and more characteristic of the people. The general tendency in all countries is towards "herd" structures in styles of relentless severity and with extravagant lighting; but the new buildings on the continent are not without charm and are superior in accommodation. As time goes on the styles will be softened by the workings of tradition, and the result will be an architecture which will compare favourably with the best of past times.



VIENNA.

Another block of modern flats, the Hantuschhof, recently built in this capital.

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Perfecting the Talkies.

By V. H. L. Searle, M.Sc.

Lecturer in Physics at the University College of the South-west of England.

The achievement of continued simultaneity between sound and movement is among recent developments in the production of talking pictures. The author makes the interesting suggestion that broadcasting, television and talkies are likely to be combined in a novel form of entertainment for the home.

AN elementary method of playing gramophone record accompaniments to cinema pictures had an early, but short, existence. When the record was played the motor driving the turntable caused an illuminated pointer to move over a dial which could be seen by the cinema operator in his box. The film carried a similar pointer and dial printed alongside the picture and, as the film passed through the projector, the pictured pointer rotated. It was the difficult task of the operator to keep his machine going at such a rate as to maintain the two pointers in step with one another. This, however, was too inexact for the degree of precision essential to realism, and the failure of the experiment showed that the eye and ear were very sensitive in the detection of a small error in timing.

It is natural, therefore, that efforts were made to render the timing entirely mechanical. The difficulties have been overcome in what now seems to be the obvious way, so that the gramophone record method has been given a new impetus and the possibility of triumphing over its more intricate rival, the sound-track method, which will be described later on.

An Electric Pick-up.

In this new development, assistance is given by the comparatively recent use of an electrical pick-up for the playing of records. It is generally understood that the record carries on its surface in a spiral groove indentations of varying size, shape, and depth to correspond with the characteristic air movements which convey to our ears identifiable sounds. Normally the needle, forced to follow the contour of these impressions, impresses on the sound-box movements which correspond with those of the eardrum in the act of hearing. The diaphragm of the sound-box produces similar movements of the air layer nearest to it, and thus a stream of sound waves issues from the horn or cabinet.

When an electrical pick-up is used, the needle is attached to an electromagnet, so that its vibrations are converted into corresponding electrical currents, which

may be led into an amplifier of the form so familiar to owners of wireless sets. The vibrations are thus magnified without serious distortion to an extent which enables them to work a series of loud speakers placed behind the screen. By this arrangement, the speech and music are capable of giving the impression of arising from the visible scene portrayed on the screen. To utilize this effect to the greatest possible extent, the loud speakers behind and above the centre of the screen are tilted downwards, while the lower ones point upwards, so that their lines of projected sound waves intersect on the screen itself or just in front of it.

The Projection Machine.

The projection machine is driven by an electric motor which is geared to, and rotates, the gramophone turntable, and thus any small change in one speed of presentation—although in practice no great variation is obtained or permissible—is accompanied by an exactly similar change in the other. If, therefore, they begin in step, they necessarily remain together. In this way, the problem is reduced to the one difficulty of a correct start, and again very little is left to the discretion or skill of a possibly not infallible operator.

A gramophone disc, however, even in the large sizes made use of, cannot contain a record of sufficient length to supply one of the long films now customary. Some means of change-over becomes necessary as soon as one disc is finished, and, if possible, this must be done without any indication of a break. Much can be done by intelligent placing of the legitimate and permissible silent periods, but such a device would soon draw attention to itself by the regularly recurring cessation of sound. As an alternative, two projecting machines, each with its own gramophone attachments, are used. While the first machine is in action the other is made ready with the second disc and the following film portion. Just before the time of change-over arrives, the second projector is started up and, at the exact instant, a double shutter is pulled

across the operator's box, thus covering the window of the first machine and opening that of the other. Nothing of the change is observable from the auditorium, scene and sound apparently continuing without pause, while actually the work has been taken up on the duplicate projector.

That this method is fairly satisfactory is shown by its continued employment, but it cannot be said to be ideal. Offsetting its advantages are a few definite disadvantages, none of which, however, appears to be insuperable. A good point is the excellent quality of music obtainable from gramophone records which, unfortunately, is to some extent lost at present in the subsequent magnification of intensity necessary to supply large halls with a sufficient volume of sound.

Another drawback is the weight, bulk, and vulnerability of the large number of records required to supply a "super" film with its sounds. Here research is likely to provide a light and durable material sufficiently tough to enable very thin records to be made and thus to combine strength with economy of bulk. Quite possibly the new discs will be metallic, for experiment in industry is rapidly providing a sufficient diversity of materials to satisfy almost all requirements. A graver difficulty is encountered in the case of a badly disfigured piece of film, although this is not of frequent occurrence in these days of great output and rapid supersession. In the early days of the cinema, the faulty strip would be cut out, the parts re-cemented, and nobody would be seriously perturbed by the omission. When sounds go on uninterruptedly, however, this would not do, as the rigid linkage between film and record is just as effective in continuing a lack of agreement as it is in maintaining a unison. It is therefore essential that the rejected piece of film should be replaced by another, even if it be blank, of exactly the same length.

The second system—commonly called the sound-track system—is apparently an involved method of achieving a simple result. Briefly summarized, the chain of processes needed for the recording and subsequent presentation include an initial transformation of sound into electricity and then into fluctuations of light, which are permanently recorded on the film alongside the scene. Then, in the cinema,

a reverse change from light to electricity is needed to actuate the loud speakers.

The first stage—from sound to electricity—is now a commonplace. The telephone does it; microphones are installed when it is desired to enable a speech to be heard by a larger audience than can be reached by the speaker's unaided voice; the provision of a wireless broadcast service depends upon its possibility. In all these cases the sound waves impinge on a diaphragm and set it into sympathetic vibration. This movement causes a correspondingly varying current to flow in the microphone circuit, and the faithfulness of the correspondence is indicated by the not sufficiently appreciated exactness of the reconverted rendering. These microphone currents may then be made to create their counterparts in

the form of a varying degree of illumination from a lamp by a number of methods. For example, a galvanometer may be employed, that is to say, an instrument which receives an electric current and indicates its existence by the movement of one of its parts, usually a coil of wire or a magnet. The amount of this movement is proportional to the strength of the current, and thus if a pointer is

attached to the coil or magnet the instrument may be made to register the magnitude of the current by its position relative to a scale. If, instead of a pointer, a mirror is affixed, then, by its movement, a beam of light can be sent more or less completely through a slit, the amount of light passing through being governed by the position of the mirror, *i.e.*, by the strength of the current.

Suppose, now, that the cinema film is being drawn along behind the slit, then it is clear that a darkening of the film will be caused to an extent governed by the amount of light it receives. In this way, the film is impressed with a record, in light and dark bands, of the variations of loudness in the original sound waves. By itself, this would be insufficient, since we do not recognize the saxophone merely by its loudness nor a speech by its rantings and whispers. In addition, the sound track must reproduce the characteristic frequencies, or rates of vibration, by means of which the quality of a note or the identity of a word becomes recognizable. Here, an ordinary galvanometer would fail, as it is insufficiently quick in its response. There is a form of tightly strung

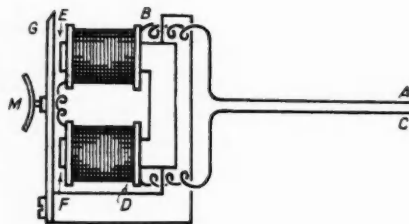


FIG. 1.

There are several methods by which the identity of words reproduced from the sound track are made recognizable in the cinema. The arrangement here shown is described in the text.

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It will be dark lines the faintest sounds, so positive principle this negative of densities loudest so represented lines. When kind is exar will be seen band, dark and light a runs beside throughout sound track record is p appropriate the two aut

In the cinema the recording sound track sounds. T practice, the very interesting the selenium resistance electric current positive and by a short special form current will poor conductor if a light resistance which floods by placing of light an

galvanometer called an oscillograph which could be, and is, used, but other methods are available. For instance, the microphone current could be made to influence an electromagnet, on the armature of which is placed a mirror. Such an arrangement is shown in Fig. 1. The wires *AB* and *CD* lead from the microphone circuit to the electromagnet *EF*, and the changes in the current passing through the windings on the two electromagnet coils produce a varying degree of magnetism in the pole pieces *EF*. As a result, the reed *G*, which carries the mirror *M*, is pulled towards the magnet by a similarly changing force, while a beam of light reflected from *M* moves across the slit under the action of this vibration.

It will be understood that this causes a number of dark lines on the moving film underneath the slit, the faintest lines corresponding with the weakest sounds, so that, when a positive print is made from this negative, the reversal of densities results in the loudest sounds being represented by the faintest lines. When a film of this kind is examined, the lines will be seen as a fluted band, dark in some parts and light at others, which runs beside the pictures throughout the record. This band is known as the sound track, and it should be clear that, as the sound record is placed with exactitude in relation to the appropriate scene, no problem of synchronism occurs, the two automatically keeping in step.

In the cinema, the task is to perform a reversal of the recording process by making use of the fluted sound track to produce a resemblance of the original sounds. This is not an easy operation, and, in practice, the means available are restricted to two very interesting phenomena. The first is known as the selenium property, and is concerned with the resistance offered by the semi-metal selenium to electric currents. The observable fact is that, if the positive and negative poles of a battery are joined by a short length of selenium, which has received a special form of heat treatment, then only a small current will flow, thus showing that the metal is a poor conductor. But this current increases greatly if a light shines upon the selenium. In fact, the resistance depends largely on the amount of light which floods the junction. It follows, then, that by placing the film between a concentrated source of light and the selenium cell—as the junction is

called—a varying current will result from the differing amounts of light transmitted by the dark and light portions of the sound track. Unfortunately, the selenium cell does not respond immediately to a change in its illumination, nor is its response sufficiently nearly proportional to the light fluctuations, and, as a result, the arrangement is incapable of satisfactory use for the reproduction of speech or music, and it has therefore been abandoned in favour of the photo-electric cell.

Within the operator's fire-proof box may first be noted the twin projectors with their gramophone mechanism alongside—for most up-to-date cinemas are equipped to present talking pictures by both methods—and the electric motor which drives the camera and turntable near by. On the front wall, which contains the two windows through which the

beams of light enter the hall, is mounted a switch-board carrying, in addition to the keys and plugs required for putting the electrical system into operation, measuring instruments for checking the current in the photo-electric cell. These indicate the voltage

applied to the amplifiers, and generally show that each member of the electrical team is working within the normal limits. At the rear of the box are the amplifiers, four sets altogether, one for each of the projectors and a duplicate to enable an easy change to be made in the event of a breakdown in the working unit.

A great deal of thought and instrumental skill has been devoted to the production of an efficient projector and, in this respect, there is very little to criticize or needing immediate improvement. It is necessary to examine the other stages in the process to find the sources of its present deficiencies, and it will be discovered that they are cumulative in effect. The fact that talking picture sound production is, generally speaking, not equal in quality to good wireless broadcast music suggests that the sound track, which is peculiar to the former, is responsible for the difference. On examination this proves to be the case. A new type of sound track aims at the control of the amount of light passing to the photo-electric cell by completely darkening a part of the sound-track width instead of partially darkening the whole. The resultant product is shown in Fig. 2 in the position it normally occupied in relation to the pictured film.

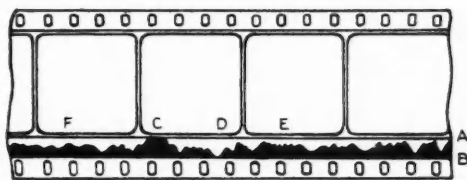


FIG. 2.

Hitherto defective sound tracks have been responsible for the fact that talkie sound production has been inferior to broadcast music. A new type of sound track, shown above, aims at a solution of the difficulty.

During reproduction, the light is incident through a narrow slit which just covers the whole width AB of the track, and thus the amount of light transmitted to the cell varies from nothing at such a point as C , where the blackening extends across the whole width, to a maximum at D . The rapidity of the change in the amount of light depends on the closeness of the peaks, the depressions in the black band being greatest at E —where a high-pitched note would result—and least at F .

An additional defect is the result of a standard rate of projection. The individual pictures on a film are very small, and into their narrow length the great range of audible frequencies must be compressed. At the same time an individual element on the sound-track cannot usefully be narrower than the slit which admits the light, and thus many of the higher frequencies—which play an all-important part in deciding the quality of the sound—are masked.

If the film were projected at a greatly increased number of feet per minute, many of the now eliminated tones would be conserved with a great improvement in realistic quality.

It seems necessary and just, therefore, to regard the talking film as a very promising experiment in a new form of entertainment which is in the early stages of a development. In view of the strenuous competition between those engaged in its development, the talkie will obviously improve with great rapidity and to a degree of reality exceeding that of present-day broadcasting. It is indeed not unlikely that broadcasting, television, and talking pictures will be combined into an entirely novel form of entertainment, in which cinema films and appropriate speech will be simultaneously broadcast to everyone possessing the necessary receiver, so that the home will be the new cinema, just as it has become the concert room and is becoming the theatre.

Tercentenary of the Discovery of Cinchona.

FROM the time when the therapeutic properties of cinchona bark became known to western civilization, until scientific research resulted in the discovery of quinine and other derivatives of the bark, there have occurred many interesting phases in the development of cinchona. Linked with the history of the bark are the pioneer expeditions by the Spaniards in South America, its introduction to all parts of the world, and the later research expeditions of British, French, Spanish and other investigators.

An international exhibition to mark the tercentenary of the first recognized use of cinchona bark was recently held at the Wellcome Historical Medical Museum. The purpose was to illustrate in outline the historical development of the bark. Its therapeutic properties are believed to have been known to the native Indians of Peru, who passed on their knowledge to the Jesuit missionaries after the conquest of Pizarro in 1527.

The first medicinal use of cinchona appears to have been in 1630. Distinguished authorities have stated that, when the Spanish corregidor of Loxa was taken ill with fever, he was cured by an Indian cacique, who revealed to him the properties of the bark and the proper way in which to administer it. Soon afterwards, the Jesuits despatched supplies to Spain.

In 1879, Dr. Henry S. Wellcome visited the indigenous cinchona forests in South America to investigate the methods employed in stripping, preparing, drying and packing the bark for transport.

He also made a close study of the conditions under which these operations were being carried out. Special consideration was then paid to the practicability of reforestation and of scientific methods by which plantations could be established for the cultivation of high-grade cinchona trees. The sites of the indigenous forests had been devastated by the destructive methods practiced in gathering the bark in former times. It is unfortunate that no effective methods have been taken to protect and conserve the cinchona trees in the principal forests, with the result that the bark-producing countries of South America have lost their world market, and, consequently, a substantial revenue.

A wide collection of cinchona specimens was shown at the exhibition, as well as objects of interest associated with the history of quinine. The King of Spain sent three of the original serons of the bark, brought from Peru by the expedition sent there by Carlos III in 1777. Another interesting exhibit from the same source was the samples of the original interior packing of the serons in which the bark was sent. Specimens were also shown of the eight most important cinchona alkaloids. Quinine is generally accepted as being the most valuable, but there have always been dissentients from that view, and although many attempts have been made to settle the question from clinical trials, the results are inconclusive. It is thought possible that more definite results may be obtained by carefully controlled trials in bird malaria.

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Charing Cross Bridge and the Adelphi.

By Daphne Shelmerdine.

One of the chief difficulties confronting the Charing Cross Bridge scheme is the sloping north bank of the river, and this problem recalls earlier attempts to overcome the difficulty, the most noteworthy of which was the building of Adelphi Terrace. The architectural aspect of the achievement is here outlined.

MORE even than most large towns, London in its vast growth has obliterated the contours of the ground on which it stands. The slight undulations in the flat valley of the Thames, once perhaps apparent in fields and marshes, are now invisible except, for instance, as one climbs the short rise of Ludgate Hill to St. Paul's. It is only when walking down the sharp incline of Savoy Hill, or looking over Adelphi Terrace, that one realizes that the Thames lies some forty feet below the level of the Strand. Yet this short distance has presented its problems in the development of London, and is one of the factors in the problem of Charing Cross Bridge.

Many Problems.

The Charing Cross Bridge scheme is again in the melting-pot, and it is impossible to say what solution will be found to its difficulties, or when they will be solved. It is certainly not a case for hasty decision, for, apart from the questions of road and rail transport involved, the aesthetic possibilities of the site are enormous. The report on the Royal Commission's scheme stated that the central difficulty lay in the attempt to provide both "roadway and railway facilities by means of a double purpose bridge . . . on a restricted site," and for this reason the alternative proposal was made, whereby Charing Cross Station was transferred to the south bank of the river. The necessity for constructing both a railway and a roadway bridge meant, among other difficulties, that while the railway on the lower deck would be level throughout, the road would have gradually to descend from the north bank to a point about one-third of the length of the bridge across the river. For it will be remembered that the road had not merely to rise to the level of the Strand, but had to pass over the top of Charing Cross Station and to cross the Strand at a higher level, in order to relieve the congestion of traffic there, terminating at St. Martin's Place. So the bridge from the north bank would have an undesirably lop-sided appearance, caused by the slope of the road for one-third of the way. Even then, it was stated that the height allowed to

the station below was not sufficient for a modern terminus.

As those who studied the plans will know, the alternative schemes to this—both the plan keeping the station on the north bank and that transferring it to the south—obviated this difficulty by a bifurcated road which went round the station and not over it. In this way it would be possible to construct a bridge with a level parapet throughout. Without entering into the questions of traffic facilities, and the development of the site behind Charing Cross, the aesthetic advantages are obvious as far as the bridge is concerned. After all the discussion concerning the saving of Waterloo Bridge, it would be a pity, to say the least, if a new bridge were constructed which, however practicable and useful, was perfectly hideous. "Such a bridge, and its approaches," the report stated, "occupying as they would so unique a site, should be the joint work of engineers and architects in collaboration."

It remains to be seen what solution will be discovered to the many conflicting aspects of the problem, but in considering the question from the point of view of the sloping north bank, it is interesting to recall earlier attempts to develop it in a manner worthy of the river below, before the question was complicated by the existence of a great terminal station. Adelphi Terrace represents perhaps the most interesting.

A Remarkable Enterprise.

The banks of the Thames have mostly been developed in the most haphazard manner, but the Adelphi remains as the deliberate attempt of the eighteenth century to ennoble the north bank. Probably it will not remain for long; it has expected destruction for years, so that those who have any affection for it, or take any interest in its history, will do well to admire it while it still stands. The attempt was one of private enterprise, a remarkable enterprise considering its size.

In 1768, when the four Adam brothers leased the site for ninety-nine years, the remains of Durham House stood upon it, with a courtyard on the bank

of the river which was merely an unsightly tangle of small sheds and coal cellars. They built the Adelphi in five years, and lived in the first house built on the Terrace (number four) from 1772 until 1778. Robert Adam was practising in Robert Street in 1772, as drawings bearing this address and date show. The brothers did not complete this enterprise without considerable opposition, nor without loss to themselves. A contemporary rhyme says:

"Four Scotchmen by the name of Adams,
Who keep their coaches and their madams,"
Quoth John in sulky mood to Thomas,
"Have stole the very river from us."

For the Adam brothers did not wish merely to build houses on the site between the Strand and the river, but to ennoble the bank of the Thames; and in doing so they had to encroach on the river. This encroachment was the cause of considerable legislation, counter-petitions, and an outcry from the City of London.

The Strand in 1768.

In those days the bank of the Thames was irregular at this point, widening into a shallow muddy bay on the north bank. The river is said to have been fordable here in ancient times. We have to imagine the Strand as it once was: a narrow muddy lane leading to the City. At first, nothing but a dangerous and unprotected road by the marshy side of the river, it came later to be inhabited; mansions were built on its south side, with gardens which sloped down to the river, where dwelt those who were brave enough, or fortunate enough, not to fear molestation while living outside the walls of the city. One of the best known of these houses was Durham House, the town residence of the Bishops of Durham. As one historian rather naïvely writes, bishops could live in the suburbs without fear of attack, while noblemen had to seek the protection of the city walls. (There was not always, we think, so much difference between noblemen and bishops, either in wealth or in predatory habits.) In Elizabethan times, Durham House became the property of Sir Walter Raleigh, who received it from the Queen and lived there from 1583 until his fall in 1603. From here he published the "Report of the Truth of the Fight about the Isles of the Azores" and the "Discovery of the Empire of Guiana." Close by, was York House, the London dwelling of the Archbishops of York, where Francis Bacon later lived. When he was compelled to leave, it passed to George Villiers, first Duke of Buckingham, King James's "Steenie." An old drawing of Durham House shows it in those days as a battlemented castle, whose walls

were washed by the Thames. Fine barges went up and down the river, and each great house had its stairs at which the inhabitants embarked.

To return to the eighteenth century, the Adam brothers leased the property for ninety-nine years at an annual ground rent of £1,200. They started work immediately, though the agreement was apparently not signed until the year later. Robert and John seem to have been the architects, and James and William were associated with them on the business side. They tore down Durham House, and planned to lay out the estate in dwelling houses. But it was not their intention simply to build streets and houses. The York House estate, which lay next to Durham House, had been sold by the second George Villiers for building purposes in 1672, on condition that the streets into which the property was divided were named after him. The adjoining property is similarly marked by the personal names of its owners, and since the Adam brothers laid out the property as a connected whole, the site is still, of course, called the Adelphi.

It was always Robert Adam's unfulfilled ambition to erect a great public building, an ambition for which opportunity came to him only in the work which he undertook, but never completed, in the last years of his life in Edinburgh. He was the first to conceive a number of private houses in London, other than a street, as a single building, instead of a collection of unrelated units. He thus recognized that the planning of a notable site, whether for private houses, or State offices, or public roadways and bridges, is a matter of public importance and not of private caprice, which takes no account of proportion and surroundings. In this he claims the recognition of our age, as he does for his architectural treatment of interior walls, to which we are returning after the Victorian method of piece-meal decoration. Adelphi Terrace was planned as a building worthy of its site on the river. When it was first built, it stood alone, for Somerset House and its river front were not completed until some years later. Its construction on the slope above the muddy shore is an enterprise of interest to those who are watching the present development of the north bank of the Thames round Charing Cross.

The Original Plan.

The Adams determined to plan the whole group of houses on a level with the Strand, and to effect this by raising them on arches, in some places on a double tier, which should form a terrace on the river side, and thus use the slope to the greatest advantage. They treated the houses fronting the river as one building, ornamenting it with a centre group of eight

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pilasters and similarly decorating the end houses each with four pilasters. The terrace was completed by the projecting end houses of Robert Street and Adam Street. The effect has, of course, been greatly marred by Victorian renovation, which was responsible for decorating the houses with stucco and erecting an absurd pediment over the centre of the building. A collection of sheds and outhouses, and the Embankment Gardens, now lie between it and the river. A contemporary engraving shows the building as the Adams planned it. The terrace stands alone, supported on fifteen arches; in front, there is a flat platform with shallow steps leading to the river, at which boatmen are seen unloading. The stairs close by were, in fact, long used for the stores brought to Hungerford Market, but the Adams' original plan for a flat platform with wharves and open arcades was abandoned in favour of a roadway with docks and warehouses.

The Adelphi was an ambitious, and in many ways a rash, undertaking, which involved the brothers in serious financial difficulties. But it was an age of speculation and gambling; the time, in fact, of the South Sea Bubble. The Adams were at the same time building houses in Portland Place and Mansfield Street. Difficulties dogged the building of the Adelphi. The construction was found to be two feet too low at base level and became inundated, and therefore the dock road was substituted for the flat platform on to the river. The embanking of part of the Thames was violently opposed by the City of London, who petitioned against it unsuccessfully, and then sent a second counter petition to the King.

An Act was passed, however, in 1771, enabling "certain persons" to enclose and embank part of the River Thames in front of their property at their own cost. The preamble to the Act stated that the river was much wider at this point than at either Westminster Bridge or Blackfriars Bridge, between which it lay, and that consequently the rapidity of the stream was lessened; the embanking would therefore be beneficial. It is difficult to say exactly why the authorities of the City of London were so opposed to the scheme, which removed a shallow,

muddy river bank which was both unsightly and unwholesome. Perhaps it was partly the novelty of the idea and the size of the undertaking on the part of private citizens; perhaps partly because they were Scotsmen, for, as the rhyme about the "four Scotchmen" hints, the Scotch were not popular in London in those days.

Then the Adams had difficulty with their workmen, whom they had imported from Scotland, together with a piper to encourage them in their labours! Finally, their financial difficulties became so great that they had to sell the Adelphi, and this they were allowed to do by a lottery, sanctioned by a special

Act of Parliament. In 1773, before the Adelphi was completely finished, an Act was passed "for enabling John, Robert, James and William Adam to dispose of several houses . . . and other their effects, by way of chance." The lottery prizes ranged from £5 to £50,000, and raised £218,000.

A rare pamphlet published by the Adams on 18th January, 1774, declares their own motives; it says that the enterprise was too great for their private fortunes, that it

was undertaken from enthusiasm for their art rather than for profit, and that their only wish was to regain the money paid out.

The building of the Arches was a premature scheme. If the vaults had been constructed to-day, with steel and concrete, and fitted with electric light, they could have been useful. They became, as we know, a famous haunt for desperate ruffians, until they were closed in 1865. When the Thames Embankment was built in 1864-70, and the water withdrawn to a still greater distance, the iron which had been used in the Arches contracted and split the masonry, and later came the Victorian "renovations" to the Terrace. It is interesting to note that the little bridge over William Street (now Durham House Street) was built by William Adam for Coutts, the banker, to give access from his private house to the bank, then on the south side of the Strand. The Adelphi remains, apart from its many literary associations, the memorial of a spirited attempt to develop the north bank of the Thames.



[British Museum.]

THE ADELPHI IN 1772.
This reproduction from an engraving in 1772 shows a view of the south front of "the new buildings called Adelphi, formerly Durham Yard."

Book Reviews.

Dust to Life: The Scientific Story of Creation. By BURTON PETER THOM, M.D. (Ernest Benn. 21s.).

Creation in its essence is still a mystery, as it was when the simple story of Genesis was written. But modern scientific research in countless directions has enabled us to envisage more or less clearly the slow development of the earth from its first stage as a molten mass spinning round the sun, and to trace in considerable detail the evolution of life from its elementary forms to the human race of the present day. There are vast gaps in the narrative, and many sections are obscure. Yet the evolutionary process as a whole has become increasingly intelligible, and every year brings fresh discoveries to supply new links in the endless chain.

There must always be a welcome for any serious attempt to provide the general public with a conspectus of what is now known about this enthralling subject. Dr. Thom, the learned American physician who has written "*Dust to Life*," deserves special commendation because he has deliberately kept in view the needs of his unlearned readers, while striving to present, accurately and dispassionately, the latest theories of scientific authorities on the many difficult problems involved. The author is careful, for instance, to explain the meaning of the terms of Greek origin which scientists delight to use; such translations are particularly helpful in the long and interesting chapters on prehistoric animals, whose scientific names convey little to the ordinary man. Again, he gives a large number of the ingenious pictures of these extinct monsters and of types of primitive man which American museum directors have developed in recent years to a high pitch of excellence; such drawings may be criticised in detail, but they are most helpful to the general reader, who wants to know what a smilodon (the sabre-toothed tiger), a dinotherium or a brontosaurus looked like when its gigantic form trod the earth. Provided that the artist is controlled by the scientist, as in these cases, there is everything to be said for the use of such illustrations, which show most vividly how types of animals adapt themselves to their environment and disappear when the circumstances change.

The evolution of the horse, through countless ages, from the little hyracotherium of the Eocene period—a creature not much larger than a cat—is admirably shown, for instance, in one of Dr. Thom's diagrams in his chapter on "*The Courses of the Dawn*." While the gigantic brontosaurus, over a hundred feet in length, proved unable to perpetuate its kind, the small hyracotherium was adaptable enough to withstand all the cataclysms of nature and to evolve gradually into the Suffolk Punch or the Derby winner of to-day.

The author is judiciously vague in his discussion of the really critical question of the origin of life. How did inanimate matter, however elemental, acquire vitality? It was, he says with Lavoisier, a chemical process, but the impetus that started the process is still to be sought. When once the bacteria had appeared, followed by the algae, the evolutionary course was well advanced, but the mystery of the beginning remains. It is the same with the making of man. Dr. Thom's thoughtful chapter on the subject states the ascertained facts, mainly after Sir Arthur Keith, but does not fail to remind the reader that much has still to be discovered in regard to the early forms of the human race. He ends with a brief and cautious chapter on

pre-history, and with a somewhat daring assertion that the race will become homogeneous, a mingling of white, yellow, and black. He ridicules the popular American belief in the superiority of the "Nordic" type over the Mediterranean. His reference to the Glozel "finds" is guarded, but might now be more definite in repudiation of their genuineness.

A Year on the Great Barrier Reef. By C. M. YONGE, D.Sc., Ph.D. (Putnam. 21s.).

The leader of the expedition which went out to investigate the Great Barrier Reef in 1928-29 gives this book the sub-title "*The Story of Corals and the Greatest of their Creations*." Writing in *Discovery* shortly after returning from Australia, he pointed out that a considerable time must elapse before the full results could be published. The present volume is not an official record of the expedition but a narrative of personal experiences, written mainly for the general reader rather than for specialists. It can be safely asserted, however, that fellow biologists will greatly profit by this book, which Dr. Yonge is to be congratulated for completing so soon, while the expedition is still topical.

Though never before investigated in detail, the Barrier Reef played a notable part in the history of science. It was in 1830 that Darwin visited the atoll known as Cocos-Keeling, during the famous cruise of the *Beagle*. This short visit had a profound influence on his book about corals, which ranks only second in interest and scientific importance to "*The Origin of Species*." Earlier in the present century Dr. F. Wood Jones spent about a year on Cocos-Keeling, afterwards publishing his well-known volume on corals and atolls.

The many subjects dealt with by Dr. Yonge include a fascinating account of the reef animals and the experiments made on them. Although so simple in structure, a coral is an animal with the same functions to perform—except motion—as more complex creatures. Certain corals have greater powers than others, and the loose mushroom coral can not only remove sand from its surface with ease, but can actually push its way upwards if temporarily buried by sand. This function is illustrated in a striking way by a series of photographs showing the amount of sand removed at intervals of two hours. Perhaps the most dangerous reef inhabitant is the stonefish, which so closely resembles its surroundings that only the aborigines can recognise it against the coral background. The fish is a feeble swimmer and relies for defence on a row of spines, which at a hint of danger are erected, a most virulent poison being ejected at the slightest pressure on the body. The aborigines have a horror of the stonefish, and at certain initiation ceremonies a model of the fish is used to instil the necessary precaution into the young men of the tribe. Terrible agonies with several months' illness are produced by the poison, which recent research has shown to have a direct effect on the nervous system. The only remedy is to keep the patient unconscious by injections of opium until the pain becomes bearable.

Dr. Yonge describes other native customs encountered in his travels. At Warrior Island, where the people are ruled by a chief of exceptional character, the school teacher and Anglican priest are also natives. The village is laid out on a definite plan, with well-built houses, and the unique hobby of the people is sailing model boats. Beautiful luggers and cutters, three or four feet in length, are made to race so quickly that they have to be pursued in full-sized vessels.

Many photographs and maps are included in this book, which achieves the high standard that has come to be associated with

the travel book, the favourite introduction of Haven Putnam, had himself, Yonge's book.

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In the past, abstruse books, down to the changing, to Sir James Jefferies, and now Prof. all that is known, the author is, conclusion by a different view, gives you the very many results of extraordinary man, whose life fully curtailed.

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the travel books issued by Messrs. Putnam. Travel was the favourite interest of the founder of the firm, Major George Haven Putnam, who, when he died recently at the age of eighty, had himself crossed the Atlantic more than sixty times. Dr. Yonge's book is worthy of its publishers' traditions.

The Biological Basis of Human Nature. By H. S. JENNINGS. (Faber & Faber. 15s.).

In the past it seems to have been usual for great men to write abstruse books and for small men to endeavour to abstract them down to the level of the public, but the fashion seems to be changing, to the great advantage of science. Quite recently Sir James Jeans has popularized the knowledge of the universe, and now Professor Jennings has translated into simple language all that is known concerning Heredity. It is quite obvious that the author is a first-class teacher. He leads his reader to some conclusion by a clear explanation, and then he starts again from a different view point and hammers in the fact; yet he never gives you the impression that he is repeating himself. To very many readers, scientific and otherwise, this book will prove of extraordinary interest, and I can imagine that to the medical man, whose biological work during his training has been shamefully curtailed, it will in many ways be found to be useful.

There are sixteen chapters, and the preface in itself is a statement as to what they contain. All we need do is to indicate how the book evolves. The first chapter outlines the theory of genes, and the second shows how that theory is proved. The third shows that the cytoplasm is equally important with the genes in the production of the organism, that constant interaction takes place between nucleus and cytoplasm so that the genes alter their environment and are themselves affected by the change. Next the hormone is introduced, a secretion produced by certain glands, as a result of the work of the genes, and it is shown how the genes are influenced by the hormones. Then the effect of external conditions is introduced, and vitamins and their actions are discussed, and so on step by step.

It is, however, interesting to note that what biologists usually describe as the "inheritance of acquired characters" is not dealt with fully until Chapter XV, and although no doubts are expressed as to the results obtained, the author, almost for the first time, gives the impression that he is not speaking with complete confidence.

One point which the lay reader will learn from this book is how work, apparently not of the least value to mankind, may ultimately become the basis of some theory of immense importance. So far as the general public were concerned, Professor Morgan, in the United States, wasted his time breeding a lot of dirty little flies in decaying fruit; and yet his work upon *Drosophila* has been fundamental in connection with the theory of genes, the function of the X chromosome and the explanation of how characters are handed down from parent to offspring. Some of these research workers have an intuition as to what will ultimately come from their work, while others are inspired solely by the desire to know. Much of such work may remain for years, apparently of no value whatever, until someone finds how it fits in with the general scheme of some important theory. Thus the work of Gregor Mendel on crossing different varieties of peas, etc., was completely lost sight of until about twenty years after his death, when it was rediscovered, and now forms the basis of a theory of Mendelian or Factorial Inheritance, which aids very considerably in the work explained in the book under review.

Last and First Men. By W. OLAF STAPLEDON. (Methuen & Co. 7s. 6d.).

The future of the human race, not through a few centuries but through many millions of years, is the theme of Mr. Stapledon's book. He imagines a philosopher who, knowing that the collapse of the solar system presages the doom of mankind, and having the power, so to say, of reversing time, transmits to our generation a detailed record of all that has happened between our day and his. On this assumption we are told how the race underwent successive eclipses and transformations, while the globe changed its form—on Wegener's theory—and eventually became uninhabitable. A migration to Venus sufficed man for a time. Then it became necessary to remove once again to Neptune, where the eighteenth and last race of men thrived and multiplied until the declining force of the sun and the oncoming of some new star heralded the extinction of human life in our part of the universe.

Mr. Stapledon has worked out this ambitious theme with singular ingenuity and courage. He is well versed in modern scientific theory, and expects his readers to be familiar with astronomy, the new physics and biochemistry, so that they may follow his flights of fancy through space and time. Mr. Wells's Martians and their invasions of the earth form an episode—but no more—in the long story. The trials and the collapse of our own civilization, after the destruction of Europe by poison-gas and the annihilation of all but a remnant of the peoples of America and China by "American madness," are comparatively easy to follow. The vicissitudes of the second and succeeding types of men become more and more fantastic and difficult, for the very obvious reason that the narrative lacks personality.

Moreover, some of the types introduced develop science to such a point—especially in breeding special characteristics—that they cease to seem human. The million million men and women on Neptune, whose span of life may be 50,000 years, are frankly incredible. There is a touch of humanity in the anecdote of the crew of the "ether ship" that went for a cruise in the outer spaces and returned half-crazed by the terrible immensity of the emptiness. But such passages are all too rare.

The author, through his remote informant, leaves the final impression that the most gifted human beings whom one can imagine can find no satisfaction in materialism. For them as for us the universe, scientifically speaking, is unfathomable and baffling. Mr. Stapledon's able and thoughtful book may, after all, be intended as an ironic comment on science without faith.

In the Realm of Carbon. By HORACE G. DEMING. (Chapman & Hall. 15s.).

This is a good book. It might well be used as a textbook on organic chemistry, if a companion volume were written, containing laboratory exercises and a little practical instruction. Properly taught, organic chemistry is certainly one of the most interesting branches of science from the students' point of view. The author has caught the spirit of his subject, and presents the romantic aspect well and with creditable accuracy. Why does he omit the large part played by X-ray analysis in the furthering of the science? He seems to allocate the entire credit of the discovery of the benzene ring to the chemist. Surely the credit of its confirmation belongs to the physicist.

The first part of this book deals with organic chemistry pure and simple. It is set forth admirably and is full of real

information. The second part is devoted to industrial organic chemistry, and conveys a very graphic picture of the vast and varied practical applications of carbon compounds. The chapters dealing with cellulose are, of course, given special emphasis. Finally, the author deals with biological chemistry. This is perhaps the most interesting part of the book, although, of necessity, it is more technical and at the same time more scrappy than the rest of the book. Biological chemistry demands a grounding in physiology without which it is not fully appreciable, but Mr. Deming makes the most of it and gives the reader a comprehensive idea of the importance of chemistry in the economy of living organisms.

This Scientific Age. Edited by D. C. JACKSON and W. P. JONES. (Chapman & Hall. 10s.).

The editors give a miscellaneous collection of journalistic articles dealing with technical subjects, including biography, engineering, and "informal expositions," which will appeal to the readers of ultra-popular magazines. At the head of every article is a short biographical notice of the author, written in a style entirely in keeping with the conception of the collection. It is surprising to find that Dean Inge is one of the contributors, but it should be noticed that his essay is a reprint from his book "Labels and Libels"; it is, of course, the best contribution to the book. There is a very good article indeed on the discoverer of the microscope, Anthony Leeuwenhoek. It is written with sympathy and verve and is really interesting.

Nansen: A Book of Homage. Edited by J. HOWARD WATERHOUSE. (Hodder and Stoughton. 8s. 6d.).

This book contains the speeches at a meeting in honour of Dr. Nansen last June, and is a fitting tribute to one who was not only an intrepid explorer but an untiring servant in the cause of humanity. It is generally believed that the strain imposed by his work for refugees at the close of the war was the cause of his comparatively early death this year. A scheme is already proceeding, of course, for the preservation of Dr. Nansen's ship, the *Fram*, and it is fitting that the tributes which this book contains should also be preserved as a part of the memorial in his honour.

In acknowledging Dr. Nansen's physical courage, Mr. Waterhouse recalls the explorer's adventure when, having left the *Fram* with one companion only, he engaged for a year and a half in that heroic struggle to reach the Pole, and afterwards to win his way back to the world of men. Viscount Cecil mentions the Nansen passport. When the explorer found that Russian refugees could not travel because they had no passports and no Government behind them, he solved the problem by introducing a passport of his own. The League of Nations proposed it to the Governments concerned, and to-day there are more than fifty Governments who issue Nansen passports to refugees who want them.

The Island of Penguins. By CHERRY KEARTON. (Longmans. 10s. 6d.).

As Mr. Kearton looked at the penguins, and they looked back at him, he often wondered whether he was the naturalist studying the strange creatures, or whether they were the naturalists studying the strangest of all Nature's creatures—

man. This book describes a visit to the Island of Penguins in the South Pacific, where the birds are so numerous that in places one can barely walk between their nesting burrows. Several months were spent on the island, and a unique opportunity was afforded of studying its remarkable inhabitants, the birds. A lively conception of the author's experience there is provided in a photograph which is described as "the one foreigner among five million native inhabitants." Mr. Kearton is standing solitary upon a rock, literally surrounded by a sea of penguins. He has every appearance of delivering an important speech to the birds, for they seem to be standing in rapt attention. The impression, however, is entirely mistaken, for events proved that all the penguins felt for their visitors was a mild curiosity insufficient to disturb their daily routine. They were simply standing meditatively, like an army of philosophers, gazing into space.

Much of the genial humour which marks Mr. Kearton as a lecturer has found its way into this book; it is a fascinating story engagingly told. "The scene as we landed reminded us of a seaside resort. First were the swimmers, then the family bathing parties, afterwards the paddlers, and finally the gossiping mothers at the edge of the beach." The habits of the penguin, and the facial expression of solemn enquiry with which a newcomer is greeted, give the bird a remarkable resemblance to human beings. "One penguin, with exactly the manner of a rotund head-waiter, placed himself before us, looked at us over his shoulder, and then waddled ahead as if he were guiding us to a table." The author constantly found himself, in fact, comparing the birds with people he knew, not infrequently to the advantage of the penguins.

Mr. Kearton has made the interesting discovery that these birds have a definite social sense. This is clearly illustrated in their system of roads. A series of tribal paths, which are centuries old, lead from their nests to the coast. Despite the many natural obstacles which cross them, the roads always run straight, and nothing will induce the birds to leave the track. The author made an interesting experiment by tying a piece of cord across a path. The penguins were astonished at first, but since they could not climb over the cord and refused to walk round it, they set to work to remove the obstacle. As a naturalist, Mr. Kearton regards the Island of Penguins as the eighth wonder of the world; and while he does not seek to deter anyone from laughing at the exceedingly comical expression of the birds, he appeals for a wider appreciation of these most original and likeable little creatures. The book contains nearly a hundred illustrations.

Through Many Lands by Water. By J. E. PRYDE-HUGHES, F.R.G.S., F.R.A.I. (Mondiale. 2s. 6d.).

Many readers interested in exploration and travel must regret their inability to keep pace with the more expensive publications dealing with the subject, and will therefore welcome the publication of the Pioneer Series at 2s. 6d. each. The books aim at giving briefly the story of modern and past explorations, and each contains a number of illustrations. The present book describes a trip down the Danube from source to mouth, and outlines some recent discoveries which have revealed the fact that there were civilized settlements on the banks of the river at a very early date. The seven countries through which the Danube flows are described, and the book affords a glimpse of the quaint habits and customs of the people met with, and the wild life observed.

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